THE AMERICAN GAS LIGHT JOURNAL

PUBLISHING OFFICE No. 32 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, HEATING, MECHANICAL, CHEMICAL AND GENERAL SCIENCE.

VOLUME LXXV.—No. 16. Whole No. 1,375. | NEW YORK, MONDAY, OCTOBER 14, 1901. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager. THOMAS J. CUNNINGHAM and ELBERT P. CALLENDER, Editors.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

Published on each Monday of the year, at No. 32 Pine Street, New York.

Collections are invariably made directly from this office for subscriptions, advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $5 (£1—25 francs). All payments to be made in advance. Single copies, 10 cents.

Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

Remittances should be made either by post office order, express money order registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

The American News Company, Nos. 39 and 41 Chambers street, New York, are agents for this JOURNAL. Newsdealers will send orders to them.

Books.—We will forward by express, at publisher's lowest rates, any book—scientific or otherwise—to any address in the United States or Canada. We would suggest to our patrons that to avoid the risk and expense consequent on sending us the money (we do not send books C. O. D.), that orders for books be sent us through the Purchasing Department of the American Express Company.

The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICE—
Twenty-ninth Annual Meeting, American Gas Light Association. 601

EDITORIALS—
Briefly Told 602
Death of Mr. William Wallace Goodwin—Death of Mr. J. Lee Judson—The American Association's Meeting This Week.—Notes.
Utilization of Water Gas in the Destructive Distillation of Coal, by Prof. V. B. Lewes 603
*An Improved Apparatus for Arc Light Photometry, by Prof. Matthews 607
British Columbian Coal 608
*Development of the Nernst Lamp in America, by Mr. A. J. Wurts—Concluded from page 572 609
How to Become a Foundry Foreman, by Mr. A. Frankenheim 611
Comparative Merits of the Flame and Electric Safety Lamps for Miners 612

ITEMS OF INTEREST FROM VARIOUS LOCALITIES 612
Consolidation at Port Jervis, N. Y.—Betterments at Hudson, N. Y.—Miss Dickerman Gets a Diamond Ring—Contract for the Berlin Construction Company—Mayor French Wants the Gas Rate Revised, Gloucester, Mass.—Three Personals—Control in New Hands, Warsaw, Ind.—Gas Plant for West Bay City, Mich.—The Detroit Suburban Gas Company—Annual Meeting, Consolidated Company, Pittsburg, Pa.—Something from Topeka, Kas.—Stock Increased, Toledo, O.—Executive Management, Poughkeepsie, N. Y.—May Increase Capital Stock, Waltham, Mass.—Mr. Addicks Pays for Advertising—Gas Rates Increased, Tiffin, O.—Cheaper Gas for Birmingham, Ala.—Financial Notice—A Pleasant Happening—And Other Items.

The Market for Gas Securities 613

[OFFICIAL NOTICE.]

Twenty-ninth Annual Meeting, American Gas Light Association.

OFFICE OF THE SECRETARY,
NEW YORK, Sept. 10th, 1901.

There will be an annual meeting of the American Gas Light Association held at Boston, Mass., October 16th to 18th, 1901.

The meeting will be called to order by the President, Mr. Edward G. Pratt, of Des Moines, Ia., at 10 A.M., on Wednesday, October 16th.

The meeting hall will be Steinert Hall, Boylston street, near Park square, Boston, Mass.

The headquarters will be at the Hotel Brunswick, corner Boylston and Clarendon streets, Boston, Mass.

The most satisfactory quarters are always obtained by writing in advance to the hotel people, and in doing so a reply should be requested, for which a self-addressed, stamped envelope should be inclosed, as misunderstandings may thereby be averted.

The Hotel Brunswick is conducted on the American plan, and rates for rooms will be as follows:

Rooms without bath, occupied by one person, $4 per day; occupied by two persons, $3.50 per day for each person. Rooms with bath, occupied by one person, $5 per day; occupied by two persons, $4.50 per day for each person.

While the Brunswick prefers not to take any of the members of the Association on the European plan, and has not made any rate on this plan, members who are especially desirous of adopting it may be able to make special arrangements by communicating with the hotel management.

The Lenox Hotel, corner of Boylston and Exeter streets, makes the following rates on the European plan: Single rooms, $1.50, $2 and $2.50; single rooms with bath, $2.50, $3 and $3.50. Double rooms, $2.50, $3 and $4; double rooms with bath, $3, $3.50 and $5. Both hotels are within 5 minutes' walk from Steinert Hall.

Other hotels at Boston are as follows: Copley Square Hotel, Huntington avenue and Center street; Hotel Thorndike, Boylston and Church streets; Hotel Touraine, Boylston and Tremont streets; Adams House, Washington street, south of West street; Parker House, Tremont and School streets; Young's Hotel, Court street.

The Roll Call will be made by means of the door card system. Each member upon entering the hall for the first time will at the door receive a special card upon which he will find his name, address, etc., as on the Secretary's books, and such card should be corrected and given to the doorkeeper.

Members in attendance should attend to this very carefully, as these cards are used immediately after the meeting for correcting the annual membership list. Visitors will please hand to the doorkeeper their personal cards.

A blank form of application for membership accompanies this circular. More can be obtained of the Secretary. Remember, all applications must be in the Secretary's hands by October 6th, at the very latest, otherwise they will not be acted upon at this meeting.

OCT 14 1901
SMITHSONIAN DEPOSIT.

The list of papers to be read at the meeting is as follows:

"The Analysis of Gas Accounts," by Mr. Paul Doty, Detroit, Mich.

"What is a Gas Company's Business?" by Mr. Frank D. Moses, Trenton, N. J.

"Tar and Water from Water Gas," by Mr. Wm. E. McKay, Dorchester, Mass.

"Retort Ovens as Producers of Illuminating Gas," by Mr. T. Littlehales, Syracuse, N. Y.

"Further Notes on Retort House Practice," by Mr. E. H. Earnshaw, Philadelphia, Pa.

A paper by Mr. A. B. Slater, Jr., Providence, R. I., and a paper by Mr. C. F. Prichard, Lynn, Mass. The titles of these last 2 papers have not yet been announced.

If the papers are of a sufficiently high standard the Beal Medal will be awarded to the author of the best paper presented; the question of which is best to be decided by the proper committee.

The officers are endeavoring to arrange for a lecture on some subject of interest to the members to be delivered during the meeting.

In addition to the papers and lecture, the Report of the Research Committee will deal with the question of "Pipe Standards" referred to the Committee at the last meeting, and with other subjects that should give rise to a good discussion.

During the days of the meeting all the announcements will be posted on the bulletin boards in the hotel. All members are warned to take notice thereof accordingly.

All members attending the meeting are particularly requested to wear their membership badges in plain sight, thereby greatly aiding the officers and the local committee in their work, by affording a ready means of recognition.

In order that the "Year-book" containing the report of this meeting may be published and issued to the members immediately after the meeting, notice is hereby given that, if any of the speakers at this meeting desire to correct their remarks before they are printed, they will be given an opportunity before leaving Boston, Mass., but not after. The stenographer will have typewritten copy of the principal discussions prepared at the headquarters between the sessions of the meeting, and all those who desire to correct their remarks must notify the Secretary at the close of the session at which such remarks are made, as all the reports will be turned in to the printer immediately after the adjournment of the meeting.

Special rates for transportation have been granted (viz., full fare going and one-third fare returning by the same route) by the several passenger associations named and under the conditions noted:

The Trunk Line Passenger Committee, covering territory west of New England and east of Niagara Falls, Buffalo and Salamanca, N. Y., Pittsburg, Pa., Bellaire, O., Wheeling, Parkersburg and Charleston, West Va.

The New England Passenger Association, covering nearly all the lines in the New England States.

The Central Passenger Association, covering the territory bounded on the east by Pittsburg, Salamanca, Buffalo and Toronto; on the north by the line of and including points on the Grand Trunk Railway from Toronto to Port Huron, thence via Lakes Huron and Michigan to the north line of Cook county, Ills.; on the west by the west line of Cook county and the Illinois and Mississippi rivers, to Cairo, including Burlington, Keokuk, Quincy, Hannibal and St. Louis; and on the south by the Ohio river, including points on either side of that river.

The Southeastern Passenger Association, covering the territory south and west of the Virginias and south and east of the Ohio and Mississippi rivers.

The Western Passenger Association, covering the territory west of and not including Chicago, Peoria and St. Louis—in other words, territory west of that of the Central Passenger Association.

Be sure to obtain a railroad certificate when buying your ticket for Boston. The greater the number of certificates handed in, the easier it is to get the reduction in rates for future meetings, since the railroad officials count the certificates turned in as marking the full attendance. In our case the number of certificates is from 50 to 100 less than that of the persons in attendance, and our requests for lower rates are not given the consideration they should receive.

Any members having questions which they desire to put into the Question Box should send the same to the Secretary as soon as possible, in order to give him an opportunity to have them printed and distributed to the members before the meeting so as to secure for them careful attention.

ALFRED E. FORSTALL,
Secretary.

BRIEFLY TOLD.

DEATH OF MR. WILLIAM WALLACE GOODWIN.—With deep regret we report the death of Mr. William Wallace Goodwin, whose demise occurred at his home, in Bordentown, N. J., the night of Sunday, October 6th. Deceased, who was in his 68th year, had been prominently identified with the gas industry since 1864, and in his busy, checkered life was also noted in other public ways. The funeral services, which were held in his late home, at noon of the 10th inst., were conducted according to the Episcopal ritual (the Reverend Mr. Chambers officiating), and on the Masonic order, too, under the direction of M. W. Grand Master Moore, of the State of New Jersey. The gas fraternity was well represented on the final scenes by many of its prominent members. Interment was subsequently made in St. Mary's Church Yard, Burlington, N. J., with full Masonic honors. In due time the JOURNAL will print some history of Mr. Goodwin's busy life.

DEATH OF MR. J. LEE JUDSON.—Still another death in the gas ranks that we have to chronicle is that of Mr. J. Lee Judson, who, since the amalgamation of the gas and electric lighting interests of Rochester, N. Y. (1892), which amalgamation resulted in the formation of the Rochester Gas and Electric Company, had acted as President thereof. His death happened, after a short illness, the night of the 5th inst., in his home on Lake avenue, Rochester. J. Lee Judson, who was born in Cincinnati, O., in 1847, was the son of Junius Judson, a man of varied interests in the manufacturing world, several of which had their center in Rochester. Having completed his education young Judson took service with his father, and when the Edison Electric Company, of Rochester, was organized, he was elected to its Board of Directors, and later on became its President. As said before, when the lighting interests of Rochester were consolidated he was appointed President of the amalgamated concern, and death found him in that position. He was prominently and practically identified with many other business institutions of a financial and industrial nature in and about Rochester. He served on the Board of Trustees of the Rochester University, and was chosen a Vice-President thereof at the last annual meeting of the Board. He was also President of the Board of Trustees of the Second Baptist Church of Rochester, and his membership on that Board dates back for several years. He is survived by his widow, one son and four daughters. The funeral services were held at his late home the afternoon of the 8th inst.

THE AMERICAN ASSOCIATION'S MEETING THIS WEEK.—All the preparations for the 29th Annual Meeting of the American Gas Light Association, to be held in Boston, commencing Wednesday next, have been completed to the entire satisfaction of its officers; and it must be said that he who would cavil at the scope, plan and promise of the convention, either from a technical or social point, never could be pleased. The banquet is to be held in the Brunswick, the night of the 17th, and although it was not possible to arrange for the presence thereat of the feminine contingent, owing to the limited seating capacity of the Brunswick's banquet hall, the Committee has provided that time shall not hang heavily upon the ladies while their lords sup. The general outing programme is a most generous and excellent one, and does exceeding credit to Mr. Walter R. Addicks and his associates on the Committee of Arrangements. In point of attendance the meeting promises to be a record breaker.

NOTES.—Mayor Byrne, of Spokane, Wash., has signed the extended and revised franchise recently granted to the Spokane Falls Gas Company, the main features of which were given by us last week.——Mr. George W. Graves informs us that the proper jury at the Pan-American Exhibition has awarded a silver medal to the York gas range, which award Mr. Graves says was the highest premium voted to "gas ranges exclusively."——Mr. I. C. Copley and his associate owners of the La Grange (Ills.) Gas Company, have applied for the right to extend the Company's mains to the nearby village of Grossdale. They ask for a 50-year franchise, and agree to sell gas at the net rate of $1 per 1,000. The Cicero Gas Company would also like to secure an ordinance for the place named.——At a meeting of the Directors of the Saginaw City (Mich.) Gas Company Mr. C. A. Wood was elected Treasurer and Chief Clerk of the office force, vice Mr. T. L. Patterson, resigned.——A correspondent gravely informs us that the Philippine Gas Light Company, Manila, Island of Luzon, has moved into its new, handsome and roomy office building, on Calle Bustos, Santa Cruz. The Company is interested in the placing of acetylene gas plants, but it also advertises that it carries "a large stock of American wrought iron pipe, American plumbing goods," etc.

Utilization of Water Gas in the Destructive Distillation of Coal.

[A paper read by PROF. VIVIAN B. LEWES, before Section VIII., International Engineering Congress, Glasgow, Sept., 1901.]

Last year I had the honor of bringing before the Incorporated Institution of Gas Engineers a review of recent Continental developments in the use of water gas, and pointed out the changes in practice brought about by the altered conditions in consumption, the increase in the price of gas, coal, and oil, and the cheapening of benzol; and I concluded the paper by making certain suggestions as to the use of water gas, which seemed to me, from laboratory experiments, to be full of promise.

Shortly after this, Mr. George Livesey, with that generous helpfulness which he has always shown when anything likely to advance the interests of the great gas industry was in question, gave permission for a trial of the suggested process at the Crystal Palace District Gas Works, and placed me in the hands of Mr. Sydney Y. Shoubridge, to whom I am deeply indebted, not only for the able and thorough way in which the experiments were carried out, but also for the scientific interest which he has throughout taken in the results; and it is a matter of deep regret to me that his health this summer has left the preparation of this paper to me rather than to Mr. Shoubridge, to whom the credit of the work is due.

In order to make clear the objects of the experiments, it is necessary to briefly recapitulate the chain of events which led up to them. The heavy tax on oil, and its consequent price on the Continent, severely militated against the introduction of the beautiful process of making carburetted water gas introduced by Lowe and perfected by Messrs. Humphreys and Glasgow and others; and even in our own country, and to a less extent in America, fluctuations in the price of oil have seriously interfered with the advance of the process. Under these conditions, several Continental works tried the experiment of mixing blue water gas with the coal gas, and then carburetting the mixture up to the requisite candle power by benzol, the cheapness of which, owing to the recovery plant now fitted to most coke ovens, rendered it available for this purpose.

A still further step forward was then made by introducing blue water gas into the foul main; and this was found to give a slightly better result, as the water gas took up some of the hydrocarbon vapors which otherwise would have condensed with the tar, and a small saving resulted in the quantity of benzol needed for the final enrichment.

I pointed out in my previous paper that the formation of tar during the destructive distillation of coal was due partly to the distillation from the coal of hydrocarbon vapors which afterwards condensed as liquids in the tar, and partly to decompositions and interactions taking place in the upper part of the retort among the hydrocarbons which were there subjected to contact with the heated crown of the retort and to the action of radiant heat, with the result that many compounds which would have been of value as illuminants in the gas became broken down into methane, hydrogen, and carbon.

It is also clear that as the gas and vapors generated from the coal near the mouth of the retort have only a few inches of heated area to travel, and are hurried out of the retort by the gas behind them, they will leave it almost unchanged; while the gas from the extreme end of the retort, having nothing to drive it forward, will be over baked and decomposed until it has hardly any illuminating value, but yields a large percentage of the naphthaline found in the tar and mains.

All the experimental work which I have done during the last 20 years on the analytical and synthetical actions of hydrocarbons under the influence of heat, has pointed to the wonderful influence which dilution has in checking such actions; and in the paper to which I have already referred, I suggested that if a stream of water gas could be passed through the crown of the retort during the process of carbonization, the dilution and hurrying forward of the coal gas so induced would prevent the secondary reactions from taking place, and thus a considerable gain in candle feet per ton of coal carbonized might be hoped for.

Within a few weeks of the publication of the paper, one of the most important events in the history of gas lighting took place in the passing of the South Metropolitan Gas Act of 1900, by which the standard illuminating value of the gas supplied to London south of the Thames was reduced from 16 to 14 candles, showing that our legislators had at length awakened to the fact that the interests of the consumer were best served by a plentiful supply of cheap gas of moderate illuminating power; and there is no doubt that this must be the general tendency of all gas legislation in the future. So that high power gas will soon be a thing of the past, and 12 to 14 candle gas will universally take its place.

At the last half yearly meeting of the South Metropolitan Gas Company, it was stated that, although the standard illuminating power had now been reduced to 14 candles, the returns from the testing stations of the London County Council showed that the gas sent out still had an illuminating power of over 15 candles, and that this unnecessarily high quality gas continued to be made owing to the fact that the Company's Engineers had not yet learned the conditions necessary for the economical production of the 14-candle gas. This must of necessity be a grave trouble wherever the change has to be made; and I hope that, in the experimental results which I have to bring before you in this paper, you will recognize a solution of the difficulty that is at once simple, practical and economical.

The experiments at the Crystal Palace District Gas Company's works at Lower Sydenham were commenced in July, 1900. The coal used was Derbyshire, and was from the same pit throughout the experiments. The yield of gas and candle power given by the coal was tested on a large working scale before, during and after the water gas experiments; and the results taken by Mr. Shoubridge as the standard for comparison were, under ordinary conditions of carbonization, 10,468 cubic feet per ton of 15.88-candle power gas.

It is manifest that, in order to compare the value to the gas manager of varying volumes of gas of different candle power, the only convenient and practical method is to reduce the values to candle feet, obtained by multiplying the make by the candle power and dividing by 5, when a direct comparison can be made; and with this coal the result is $\frac{10,468 \times 15.88}{5} = 33,246$ candle feet per ton.

The plant used in the earlier experiments consisted of 6 beds of 7 retorts each, and later of 12 beds of 7 retorts; the section of all retorts being 22 inch by 16-inch and 20 feet long, heated by regenerative furnaces and charged by power stoking machinery. The gas from them was passed through one complete section of the works separately, and was, therefore, condensed, scrubbed, purified, and measured in the usual way—the ordinary gas manufacture being carried on at the time, in other sections of the works.

The water gas was made in the ordinary "Economical" water gas plant, and conveyed from the relief holder to the retort house by a special pipe. This pipe was continued over the retort bench, just above the arch pipes on one side, and a connection was made from it to the top of each ascension pipe on this side of the bench. Each connection was fitted with a cock, having a lever handle with rod attached to it, so that the cock could be regulated from the charging floor. The dip pipes on this side were blocked, and the hydraulic main valves were closed. The water gas therefore descended the ascension pipes on this side passed through the retorts, and up the ascension pipes on the other side along with the coal gas.

The quantity of water gas which could be passed through each cock, when partly and when full open, was ascertained before the test by measurement through a meter. This enabled an approximate measurement of the quantity of water gas put into each retort to be made; but the actual quantity used in each experiment was checked by noting the quantity taken out of the holder. The heat of the retorts was, throughout the tests, maintained as nearly uniform as possible, and at as high a temperature as is used in ordinary working.

I was under the impression that, with a double ended retort of the kind we were using, such slight differences in the depth of seal of the dip pipe as were likely to occur would probably result in the largest proportion of gas escaping by the end at which the seal was lightest; so that I imagined that no difficulties would arise from the closing of one of the ascension pipes. But to make sure of this point, a series of trials were made with the coal carbonized alone under these conditions, when it was found that the normal make of 10,466 cubic feet per ton was reduced to 8,615 cubic feet; and the illuminating power rose from 15.88 to 18.58 candles giving, in candle feet, $\frac{8,615 \times 18.58}{5} = 32,013$. That this was not due to lowering of temperature, was shown by continuing the experiment with the previously closed ascension pipe open, when normal results were at once obtained. This result, however, made one feel that the figures obtained when the water gas came to be used would have to be taken with some reservation, as it was manifest that the normal conditions of working were not being fulfilled.

From the end of July till the end of August, the experiments were carried on continuously, in order to ascertain the best period at which to introduce the water gas, the most advantageous rate of flow to em-

ploy, and the percentage of water gas to coal gas that gave the most economical results; and during these experiments many points of interest cropped up, and the usual small difficulties presented themselves and had to be overcome.

A question which had to be settled at a very early stage in the experiments was the method by which the illuminating power of the mixed gases was to be determined. The "London" Argand, as the standard burner for all gases of less illuminating power than 21 candles, was, of course, employed; but it is perfectly well known that for gases below 15-candle power a grave injustice is done to the gas, when consumed at the 5 cubic feet rate of flow, especially when the reduction in candle power is brought about by an admixture of hydrogen or water gas with the coal gas, as when these are present in any large quantity, the size of flame given by the gas passing at the rate of 5 cubic feet per hour is so reduced that serious loss of light takes place.

The "London" Argand is a beautifully constructed scientific burner devised to supply the right amount of air to insure the proper combustion of a gas flame 3 inches in height. Directly the flame is materially longer or shorter than this, the conditions of combustion are altered. But by burning the gases at such a rate of flow as will yield a 3-inch flame, taking the candle power, and then calculating to a 5 cubic feet rate of flow, accurate results can be obtained for gases having any candle power between 10 and 30 candles; and it was this method of testing that I should have preferred from a scientific point of view. Mr. Shoubridge, however, very properly objected that this was not the process that would be adopted in testing his gas as it would be sent out, and that as it was the commercial value of the process that was in question, the right course to adopt would manifestly be to use the Referees' table photometer under all the conditions laid down in their instructions for the testing of the gas; and all the illuminating values given in the paper have been determined in this way.

In using water gas in the way proposed, it was soon found that the addition of small percentages gave but little gain; but that with an increase in the quantity of water gas used, the gain in candle feet became more and more marked, as is shown in the following table:

Water Gas Added per Cent. of Coal Gas.	Candle Feet per Ton of Coal.	Percentage Gain per Ton of Coal in Candle Feet.
28.8	35,147	5.5
35.2	36,231	8.8
41.1	40,833	22.6
55.7	40,331	21.1

So it was evident that the maximum gain in candle feet, as compared with the 33,246 candle feet given by the coal under ordinary conditions, was obtained when from 40 to 50 cubic feet of water gas were used for each 100 cubic feet of coal gas.

Another point, however, that has to be considered by the gas manager is the percentage of carbon monoxide present in the gas; and I am strongly of opinion that this should not exceed 15 to 16 per cent.—a quantity which, according to the analyses made during the experiments, would limit the use of blue water gas to about 40 per cent. of the coal gas.

Taking the experiment nearest to this figure, the full data are given as follows:

Date of Experiment, Aug. 27 and 28, 1900.

Coal carbonized	82 tons.
Make of gas per ton	13,730 cubic feet.
Water gas added per ton	4,005 " "
Percentage water gas added	41.1 per cent.
" " " in mixture	29.1 " "
Candle power	14.87 candles.
Candle feet, $\frac{13,730 + 14.87}{5}$	40.833 "
Gain in candle-feet on standard (33,299)	22.6 per cent.

Analysis of Gas.	I.		II.
Hydrogen	50.37	..	50.62
Saturated hydrocarbons	29.24	..	29.49
Unsaturated hydrocarbons	2.98	..	2.48
Carbon dioxide	0.49	..	0.49
Carbon monoxide	14.92	..	14.92
Oxygen	nil	..	nil
Nitrogen	2.00	..	2.00
	100.00	..	100.00

Calorific Value.

Calories	149.8 gross	..	132.9 net.
B. T. U.	599.2 "	..	531.6 "

If the candle power obtained by using a 3-inch (16.78 candles) flame had been taken, the gain would thus have been 29.2 per cent.

The end of August means to the gas manager the end of all leisure for the year, and the experiments had for the time to be abandoned; while in view of the doubts raised by the abnormal behavior of the coal when carbonized alone in the retorts with one ascension pipe closed, it was felt that, promising as the results were, it would be better not to publish them until a more satisfactory comparison could be made. The opportunity to do that occurred this summer, when Mr. Shoubridge, having erected a new bench of 70 inclined retorts, decided to again try the effect of water gas on carbonization.

The water gas was made, as in the previous experiments, in the generator of the "Economical" plant usually employed for the manufacture of carburetted water gas. The gas was passed into a holder of 469,800 cubic feet capacity, and was thence carried to the inclined retorts, into which it entered at atmospheric temperature. The gas was not purified before being admitted to the retorts, but was tested for carbon dioxide, of which it contained from 5 to 6 per cent. The carbon dioxide (after estimation) was deduced by calculation from the volume of water gas used, because the volume of mixed gas produced was measured in the station meters after the whole of the carbon dioxide had been removed by purification in the usual manner.

To ascertain whether the carbon dioxide in the water gas was converted into carbon monoxide by passage through the retorts, the mixed gas was examined at the inlet to the washers and found to contain 3 per cent. of carbon dioxide. It may therefore be assumed that the carbon dioxide as it passed through the retorts was not to any appreciable extent converted into carbon monoxide.

No station meter could be placed at my disposal for the measurement of the water gas. The holder of known capacity (469,800 cubic feet) was therefore filled before the commencement of each experiment; no gas being admitted to the holder during any trial. The volume of the gas was obtained by recording the height of the holder at the commencement and completion of the experiment, and making all the necessary corrections for temperature and pressure. The quantity of water gas used during 24 hours varied in the different experiments from 200,000 to 370,000 cubic feet. The gas leaving the retorts was purified in the usual manner, and then passed through station meters, from which readings were made every hour.

During every hour the gas was slowly bye-passed into a small holder, from which gas was drawn at the end of each hour so as to determine the illuminating power by means of the Referees' table photometer, and from which once a day gas was drawn for analysis, and for the determination of its calorific power by a Junkers' calorimeter.

The coal used in the experiments was the same kind of Derbyshire coal as had been used in the previous tests, but of slightly inferior quality. Before commencing the experiments with water gas, a trial run was made for 7 days with the coal alone; the tests being made every hour, day and night, so as to obtain a standard for comparison. The principal results obtained were—

Seven Days' Trial with Coal Alone.

Total coal carbonized	603 tons.
Total gas made, corrected	5,973,682 cubic feet.
Make per ton	9,907
Average ill. power (table photometer)	16.55 candles.
Total tar (hydraulic)	5,060 gallons.
Tar per ton	8.3
Calorific power (gross)	152.6 calories per c. ft.
" " (net)	138.8 " "

These figures give the value of 32,792 candle-feet per ton for the coal; and this figure is taken as the standard in the following experiments.

In arranging the apparatus for the experiments, the upper mouthpiece of each retort was fitted with a pipe and stopcock for the admission of the water gas.

These experiments were continued from June 19 up to August 23, 1901, and the passage of water gas in varying proportions through the retorts was tried, and also the influence of the period of carbonization at which the flow of diluting gas was started. It was found that, although the results obtained were far better than in the experiments made with horizontal retorts, they were of the same kind, and that the gain in candle feet per ton gradually rose with increase in the volume of water gas used, reaching a maximum with about 40 volumes of water gas per 100 volumes of coal gas, and decreasing when this point was passed.

Water Gas Added per Cent. of Coal Gas.	Candle Feet per Ton of Coal.	Percentage Gain per Ton of Coal in Candle Feet.
21.9	37,582	14.6
25.5	38,235	16.6
27.8	41,343	26.0
37.6	40,936	24.8
40.1	43,703	33.2
42.0	42,984	31.0
45.6	40,467	23.4

The most important data with regard to these experiments are tabulated at the end of the paper (Table I.); but the results are so extraordinary, and so full of interest, that it is as well to give the full data for the experiments in which 40 and 42 per cent. of water gas respectively were added, as it gives a better idea of the scale of the experiment.

Date of Experiment, July 9 and 10, 1901.

Coal used	85.4 tons
Total make (corrected)	1,274,656 cubic feet.
Make per ton	14,925
Illuminating power (table photometer)	14.4 candles.
Total tar (hydraulic)	690 gallons.
Tar per ton	8.07
Water gas added	42.0 per cent.
Water gas in mixture	29.5
Water gas per ton of coal carbonized	4,415 cubic feet.
Candle feet per ton $\frac{14,925 \times 14.4}{5}$	= 42,984
Standard for coal carbonized alone	32,792
Increase in candle feet	31.07 per cent.

Calorific Value.

Calories	127.2 gross	..	116.8 net.
B. T. U.	508.8 "	..	467.2 "

Carbon monoxide present in purified gas, 14 per cent.

Date of Experiment, Aug. 22 and 23, 1901.

Coal used	88 tons.
Total make (corrected)	1,294,946 cubic feet.
Make per ton	14,715 "
Illuminating power (table photometer)	14.85 candles.
Total tar (hydraulic)	651 gallons.
Tar per ton	7.4 "
Water gas added	40.1 per cent.
Water gas in mixture	28 6 "
Water gas per ton of coal carbonized	4,215 cubic feet.
Candle feet per ton $\frac{14,715 \times 14.85}{5}$	= 43,703
Standard for coal carbonized alone	32,792
Increase in candle feet	33.2 per cent.

Calorific Value.

Calories	125.8 gross	..	118.7 net.
B. T. U.	503.2 "	..	474.6 "

These results make it perfectly clear that a gas manager who has been supplying a 16-candle gas can, by simply putting in blue water gas plant and utilizing 40 per cent. of this gas in the retorting, turn out between 14,000 and 15,000 cubic feet per ton of 14.5-candle gas, without any alteration in his heats or general procedure.

It will now be well to discuss more in detail the economic bearing of the process. The economic aspect of the case is, of course, entirely dependent on the cost of the water gas, the price at which the coal gas can be put into the holder under ordinary conditions, and whether the purification of the mixed gases costs substantially more than the coal gas would do.

I have on several occasions pointed out the wonderful advance in water gas manufacture brought about by the Dellwik process; but, with the exception of Mr. Glover and Mr. Paterson, who went with me to some of the Continental works and verified the fact that some 70,000 cubic feet of good water gas could be made per ton of gas coke, I think most gas managers were a little skeptical as to the possibility of attaining these figures. Any doubt, however, on this point can now be put at rest without journeying abroad, as the Dellwik generator erected by Mr. Glover at West Bromwich is now at work, and I am informed turned out 74,548 cubic feet of crude water gas per ton of coke on its trial trip. So that, even with coke at a fairly high price, the cost, including all charges, should not exceed 3d. to 3¼d. per 1,000 cubic feet.

With regard to purification, the water gas contains no bisulphide of carbon, less sulphuretted hydrogen than the coal gas, and should only contain 4 per cent. of carbon dioxide. The water gas made in the "Economic" generator we have been using at Sydenham, however, averages 5 to 6 per cent.; and the mixed gases leaving the scrubbers contain an average of 3 per cent. So you can judge for yourselves as to the increased cost over that of purifying ordinary coal gas; and as when hot water gas is used instead of cold, most of the carbon dioxide in it is reduced to carbon monoxide in contact with the carbon in the retort, it is evident that increase in cost due to purification is a negligible quantity.

The question of the alteration in quantity and quality of the tar will with many be an important point. But it will be seen from Table II. that the decrease in quantity condensing in the hydraulic main is very small; while fractional distillation shows no alteration of character that can be with certainty identified without some further experiment. There is, however, a slight average increase in specific gravity and in ammoniacal liquor; so that, as far as can be at present ascertained, the process offers no grave disadvantages in this direction.[1]

An idea has in some strange way arisen that water gas when mixed with coal gas renders it less fitted for use with incandescent mantles; and the reason given for this is that the calorific value of the water gas is only some 300 B. T. U., instead of the 500 to 600 B. T. U. given by ordinary coal gas. This, however, is a total fallacy, and really only means that intelligent attention has not been paid to the air supply of the burner. With pure water gas, consumed in an Argand burner, it is quite possible to develop the same amount of light from an incandescent mantle as is obtained with the same mantle on an atmospheric coal gas burner of the usual type, consuming a mixture of coal gas and air; the reason being that, as the water gas gives a non-luminous flame, no previous admixture of air is necessary, and the gas burns where it comes in contact with the atmosphere—the whole of the heat being utilized to raise the mantle to incandescence. With the ordinary bunsen burner, however, a large proportion of the air needed for the combustion of the gas is drawn in from the holes at the bottom of the burner, and gives the inner cone of the bunsen flame, which has but little effect on the mantle. It is only the residual products of incomplete combustion that burn in actual contact with the surface of the mantle and give the chief result; while the nitrogen of the air used in the primary combustion is heated to nearly the temperature of the flame, and, escaping, takes with it a considerable proportion of the heat. So that, although the calorific value of the coal gas may be double the calorific value of the water gas, there is practically little or no difference in the temperature of the outer zones of the flames in which the mantle is heated.

With mixtures of coal gas and water gas, such as are produced by passing 40 per cent. of wat r gas through the retort during carbonization, it only requires a slight reduction in the size of the air holes of the burner to get the same illuminating effect from the mantles; while the chance of carbonization of the mantle is reduced to a minimum. It will also be found that the adoption of the process will do away with stopped ascension pipes, and will reduce naphthaline troubles to a vanishing point—factors in favor of the process which the practical gas manager is sure not to underrate.

In attempting to estimate the saving in cost which the process is likely to bring about, local factors play so important a part that it is difficult to give figures which will suit in all cases; but I think a fair idea may be obtained in the following way: A 16.5-candle power coal gas in the holder costs at the present time 1s. per 1,000 cubic feet, and the mixture of coal gas and water gas produced by passing 40 per cent. of water gas through the holder would cost:

1,000 cubic feet of coal gas	1s.	0.0d.
400 " " water gas, at 3¼d	0	1.4
	1s.	1.4d.

So that 1,400 cubic feet of 14.4-candle power gas costs 13.4d., or 1,000 cubic feet will cost 9.57d.

1. Professor Lewes remarked that this was an important point. It would be found in the experiments that they were only able to deal with the tar and ammoniacal liquor in the hydraulic mains, simply because they had in the tar well no power of separating the make from the other makes. But still what they found in the hydraulic main was a fair indication of what was going on. All the members had had before them details with regard to the Mond process; and it would be remembered that in the Mond system of gas making, a large amount of steam was blown through the fuel together with air; but, by so doing, the temperature was lowered to a point at which they had the ammonia as it was formed broken up. In this process of passing the water gas through the retort, they got with the water gas going in with the gas passing through the crown of the retort a cooling influence of the same character; and when experiments could be made on a large scale, and the various products isolated, it would be found that the increase in ammoniacal liquor was a very important one. The figures at the present time only justified him in saying that there was an increase; but it would be found that it was an important one.

If it is desired to send out 16.4-candle power gas, benzol enrichment will give the necessary 2 candles, at a cost of something under 0.75d.; so that the cost per 1,000 cubic feet of the 16.4 candle gas would be reduced to 10.32d. in the holder. The calculation may also be made direct from the candle feet yielded per ton of coal.

Taking round figures, a ton of coal under ordinary conditions of carbonization yields 32,792 candle feet, at a cost of 1s. per 1,000 cubic feet in the holder; and at 10,000 cubic feet per ton, this will cost 120d. When, however, 40 per cent. of water gas is passed through the retort during carbonization, the ton yields 43,703 candle feet; and the cost will be:

10,000 cubic feet of coal gas	120d.
4,000 " " water gas	14
	134d.

If, however, the 43,703 candle feet had been produced by carbonizing coal in the ordinary way, the cost would have been $\frac{43,703 \times 120}{32,792} =$ 159.9d.; and the economy effected would be 159.9 — 134 = 25.9d. per ton of coal carbonized.

With regard to the heating value of the mixture, it will be seen from the tables that the admixture of 40 per cent. of water gas reduces the net calorific value about 15 per cent.

The experiments, the results of which I have now brought before you, make it clear that, by adopting this method of utilizing water gas, an enormous economy may be obtained; but I am myself convinced that these results can be greatly improved upon. Instead of using cold water gas, which checks the heat in the crown of the retort, hot water gas, either direct from the generator or heated by passing through iron pipes recessed in the walls of the retorts, should be employed; while much has yet to be done in proportioning the rate of flow of the water gas to the rate of evolution of gas from the coal in the retort. And if these early experiments show so large a saving, it is not unreasonable to hope that, as the process is developed by your experience and engineering skill, even better results may follow.

I must, however, in taking leave of the subject, warn you that it is probable that much may depend on the quality of the coal; and that whereas with rich coals, shales, and cannels, the gain may run up from 30 to over 100 per cent., yet that with poor coals the results may be inferior to those I have brought before you. I, however, feel convinced that, as your investigations proceed, the possibilities of enriching water gas with illuminating hydrocarbons that are at present lost in the formation of tar, will exceed your most sanguine expectations.

In conclusion, I have to thank my assistant, Mr. H. F. Hills, for the great help he has given me, and also Mr. R. English, F.C.S., the Assistant Engineer at the Crystal Palace District Gas Works, for the constant attention he has given to these experiments, and the skill he has shown in overcoming those troubles which always arise when gas making plant is put to uses other than those for which it was erected.

TABLE III.—*Some Typical Results, Showing that, the Lower the Illuminating Power of the Gas, the Greater the Advantage Gained by Testing with a 3-Inch Flame and Correcting to 5 Cubic Feet per Hour. instead of at a 5 Cubic Feet Rate.*

Coal Gas Alone.

5 cubic feet per hour rate	14.20	14.33	16.22
16-candle flame corrected to 5 cubic feet	15.44	15.68	16.55
3-inch flame	16.40	16.77	17.90

Coal Gas with Water Gas.

Per cent. water gas added	28.80	35.20	41.40	55.70
5 cubic feet per hour rate	14.77	13.20	12.79	12.48
16-candle flame corrected to 5 cu. feet	15.60	15.06	14.87	15.43
3-inch flame	17.28	17.00	16.78	16.42

TABLE IV.—*Cost of Blue Water Gas.*

(From figures furnished by Mr. C. Dellwik.)

Yield of gas per ton of coke in generator	70,200 cubic feet.
Consumption of steam per 1,000 cubic feet	52.5 pounds.
Which with water preheated, as done by the new design of Dellwik-Fleischer generator, will require at most	7.5 pounds fuel.
For one generator to produce 500,000 cubic feet of water gas per diem, cost of labor amounts to	8s. per shift.
For two generators to produce 1,000,000 cubic feet per diem, the cost of labor would not exceed	12s. "

The cost of the crude gas then figures out as follows:

(A) For a production of 500,000 cubic feet per diem—

		s.	d.
Coke for generator,	7.14 tons at 12s. 6d.	89	3
Steam fuel,	1.7 " 5s.	8	6
Labor,	3 shifts, at 8s.	24	0
Water, repairs and	sundries	8	3
		130	0

Cost of gas per 1,000 cubic feet, 3.12d.

TABLE I.—*Inclined Retorts*, 1901.

	Coal Alone. Average Seven Days' Trial.	Water Gas Added Half Hour After Charge and Continued for 3¼ Hours.	Water Gas Added One Hour After Charge and Continued for 3 Hours.	Water Gas Added Immediately After Charge and Continued for 4 Hours.	Water Gas Added Immediately After Charge and Continued for 3½ Hours.	Water Gas Added Immediately After Charge and Continued for 3 Hours.	Water Gas Added Half Hour After Charge and Continued for 3 Hours.	Water Gas Added Immediately After Charge and Continued for 2 Hours.
Water gas added, per cent	..	21.9	25.5	27.8	37 6	40.1	42.0	45.6
Average illuminating power (table) candles	16.55	14.83	14 68	14.74	15.27	14.85	14.40	13.74
Candle feet per ton	32,792	37,582	38,235	41,343	40,936	43,703	42,984	40,467
Increase in candle feet per ton, per cent.	..	14.6	16.6	26.0	24.8	33.2	31 0	23.4
Total make per ton, cubic feet	9,907	12,671	13,023	14,024	13,404	14,715	14,925	14,726
Tar per ton in hydraulic main, gallons	8.3	7.7	7.6	7.4	7.3	7.4	8.07	8.1
Gross heating power, calories per cubic foot	152.6	133.9	128.8	122.5	126.7	125 8	127.2	126.0
Net heating power, calories per cubic foot	138.8	122.7	118.2	112.7	117 6	118.7	116.8	117.1
Carbon monoxide, per cent.	7.19	10.0	..	12.0	13.2	..	14.0	17.0
Water gas added per ton of coal carbonized, cubic feet.	..	2,276	2,654	3,057	3,667	4,215	4,415	4,615

TABLE II.—*Hydraulic Main Tar (Inclined Retorts).*

	Date 1901.	Gallons per Ton of Coal.	Specific Gravity at 70 Deg F.	Below 170 Deg. C.		170°-270° C. Middle Oils Per Ct. by Vol.
				Ammoniacal Liquor Per Ct. by Vol.	Light Oils Per Ct. by Vol.	
Coal gas alone, 7 days' trial (a)	June 19-26	..	..	1.4	2.2	20.8
" " " (b)	..	8.3	1.207	1.6	3.2	22.8
" " " (c)	..	..	1.219	2.0	4.0	22.8
Coal gas with 42.0 per cent. water gas added	July 10	8.1	1.228	2.6	2.2	20.4
" " 21.9 " " "	" 11	7.7	1.222	2.2	3.4	22.0
" " 27.8 " " "	" 16	7.4	1.221	3.2	3.6	18.6
" " 35.5 " " "	" 18	7.6	1.225	3.4	3.0	19.6
" " 23.6 " " "	" 23	8.1	1.236	2.6	2.2	20.4
" " 37.6 " " "	" 30	7.3	1.217	3.2	1.4	20.6
" " 45.6 " " "	August 1	8.1	1.209	2.6	2.8	20.8

(B) For a production of 1,000,000 cubic feet per diem—

		s.	d.
Coke for generator,	14.28 tons at 12s. 6d.	178	6
Steam fuel,	3.4 " 5s.	17	0
Labor,	3 shifts, at 12s.	36	0
Water, repairs and sundries.		16	6
		248	0

Cost of gas per 1,000 cubic feet, 2.98d.

An Improved Apparatus for Arc Light Photometry.

Prof. Matthews, in a paper on the topic named in the heading, read at the September meeting of the American Institute of Electrical Engineers, describes a photometric equipment which, while embodying certain features of Blondel's apparatus, combines simplicity of operation with adaptability to either open or inclosed arcs. A mathematical presentation is given of the theory of the apparatus, from which the conclusion is drawn, that to produce on the photometer screen an illumination proportional to the mean spherical intensity of the source, it is necessary (1) to direct toward the photometer the beams of light which the eye of an observer would receive if he were to view the source at angular intervals of 15° in a vertical plane, and (2) to reduce the intensity of the light in these directions in the ratio of the sine of the angle between the direction of view and the vertical.

In carrying out the method, a ring (Fig. 1) of 24 large trapezoidal

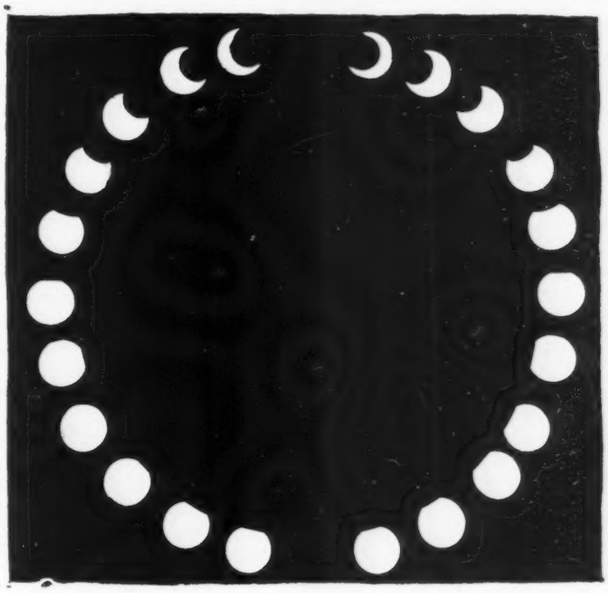


Fig. 2.—Images in Determining Spherical Candle Power.

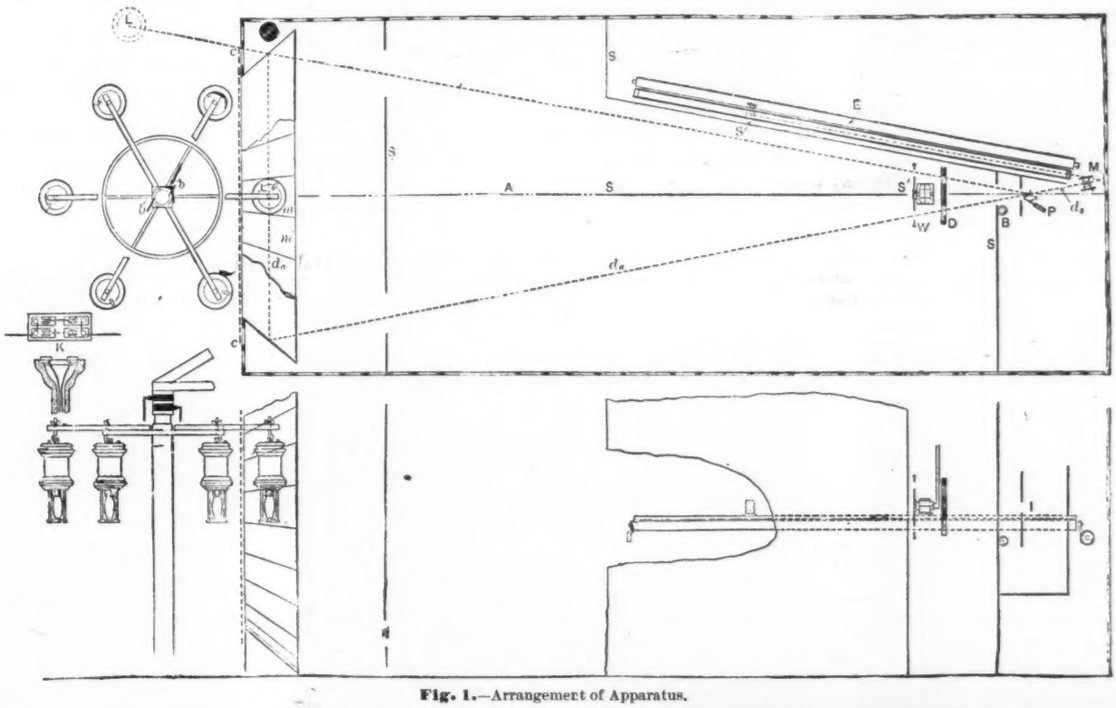


Fig. 1.—Arrangement of Apparatus.

mirrors *M M*, surrounds the arc. This system of mirrors constitutes a truncated, 24-sided pyramid. The inclination of the mirrors to the axis *A* of the system is such that the eye, placed at the photometer *P*, sees 24 images of the lamp *L*, of which *L'* is the horizontal one, precisely as if the mirrors being absent, one were to travel in a circle about the arc in the plane *oo'*, stopping at 15° intervals. Figs. 2 and 3 show the aspect of this series of images from a point near the photometer. The slight amount of displacement shown in these illustrations is due to the fact that the camera could not be placed at the optical center of the system. Fig. 2 shows the entire set of images as used in the determination of the mean spherical intensity, and in Fig. 3 the lower images only for the determination of the mean hemispherical intensity, as in the case of lamps with shades. As actually used, the top and bottom mirrors were left out, not because there may not be light in these directions, but because these intensities, when multiplied by sine *O*, do not contribute to the mean spherical intensity. Direct light from the arc is intercepted by a black screen *S*.

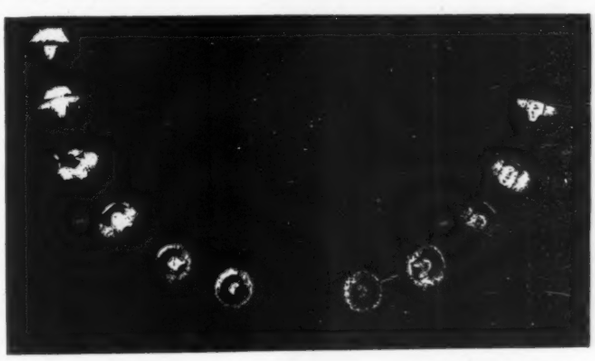


Fig. 3.—Images in Determining Hemispherical Candle Power.

This system of mirrors serves then to direct the light to the photometer screen in the chosen directions. The second condition is that the intensity of each beam of light shall be reduced in the ratio of the sine of the vertical angle. This has been done by a polygonal glass disk *D*, composed of as many sectors as there are mirrors. These sectors are smoked until they give the desired absorption. In order that the film

of smoke may be permanent, the ring of smoked sectors is covered by two plates of plane glass. These plates cover but do not touch the smoked surfaces. The three thicknesses of glass are firmly bound together, and the screen, as a whole, may be handled without fear of changing its absorption. The precaution must be taken to thoroughly clean its external surfaces before making measurements. An essential condition to the success of this method is that the photometer screen should receive through any given sector from the image in the corresponding mirror and from no other. That this condition is fulfilled can easily be determined. Thus, if all the mirrors be covered except the horizontal one, and all the sectors be covered except the sector just above the horizontal, that is, at 15° A, then if the patch of light produced by this arrangement of the apparatus falls not upon the photometer screen, but upon the black surface in the vicinity of the photometer, the required condition is met. The sectored disk is best put in place by replacing the photometer screen by a cardboard pierced by a small opening. The observer can then sight through this hole and ascertain the adjustment of the disk with reference to the system of mirrors.

The mirrors are of good quality, French plate glass. Their reflection coefficients were carefully determined for the incidence at which they are used. Some inequalities were found, as would be expected, although the maximum difference from the mean value of .815 is only + 2.9 per cent. However, in order that the apparatus might be used for the measurement of steady sources, variations of the coefficient were corrected by smoking the corresponding glass sectors. That is to say, if the coefficient of a particular mirror were high, the corresponding glass sector was smoked a little heavier than would otherwise be done.

Some care and skill are necessary to produce a uniform coating of smoke of just the required density. It was found convenient to use a sheet iron chamber, fitted with a suitable flue, and pierced near the top with a small opening for the introduction of the glass. This chamber must be placed near one end of the photometer bar in order that the absorption of the glass may be tested as frequently as may be necessary. The setting of the photometer being predetermined, each sector is smoked until it shows the required absorption. There is a tendency for the coating to form most heavily near the edges of the glass. This may be overcome by providing a guard ring of glass of the same thickness as the piece to be smoked, the whole being mounted in a convenient holder. The best results will be obtained by holding the piece of glass vertically in the smoke chamber, occasionally reversing the piece. Turpentine is a good combustible, but it must be introduced into the receptacle at the base of the chamber in small quantities, otherwise the combustion will be so violent as to produce a flocculent deposit on the glass.

In testing the glasses it is best to use a small source of light, such as a narrow slit in front of a straight filament glow lamp. Any inequalities in the coating of smoke can be detected by moving the glass about in front of this opening, care being taken that the same plane is maintained. It will be seen in Fig. 1 that the incidence of the light upon the glass is not quite normal. Care was taken to maintain this same incidence in the absorption tests.

At M_s is shown a mirror for directing the light from the temporary standard to the photometer. This mirror might have been omitted had not the limits of the photometer room already been taxed to the utmost. Still better, if the mirrors were from one large piece of glass, the direction of the photometer bar might be such that the same incidence would be had on M_s as upon the others. In this case the correction for the mirror absorption would be eliminated.

The illumination upon the arc side of the photometer screen is, of course, very intense. It is necessary to reduce this illumination. For this purpose there was used a rotating wheel W, provided with a large number of narrow radial slots. It is quite essential that the number of open slots should be large, as otherwise the illumination on the photometer screen will be seen to beat or pulsate when measurements are being made on the alternating arc. In order to avoid this the constant of this wheel was determined by direct experiment on the arc itself, and not by calculation. The mean of several determinations gave the transmission constant of the sectored wheel K_w the value of .090. The number of slots in this wheel is 48, which gives a frequency amply great at the normal speed of the motor used for driving the wheel.

A possible source of error is the diffusion of the smoked glass disk. That is to say, since the disk receives a certain flux of light dependent upon the solid angle which it subtends from each image as a center and upon the intensity of such image, it becomes, to some extent, a secondary source. The direct measurement of this is a matter of some difficulty. To determine if the correction for this diffusion were of importance, the longitudinal screen SS' was removed, the mirrors to the left of the vertical were covered, and likewise the right half of the sectored glass disk. With an arc of ordinary intensity in the center of the mirror system, it is evident that the left half of the sectored disk receives a flux of light about equal to that which it would normally receive with the longitudinal screen in position and the mirrors entirely uncovered. At the same time no direct light from the images falls upon the photometer screen. Any illumination perceived under such circumstances would be due to the diffusive action of the glass. As a matter of fact, it was found that with the temporary standard stopped down by a narrow slit, a setting could be obtained in this way when the sectored wheel was not in position, but when this wheel was running in its proper place the correction was entirely negligible. Hence no further attempt was made to take account of it.

The distance from source to photometer screen is large, being nearly 9 meters. As the incidence of the light from the temporary standard is the same as that from the arc, no correction is here necessary.

The paper gives the deduction of the working equation of the apparatus, which, for the particular apparatus described, is as follows:

$$I_{ms} = 1.17\left(\frac{865}{d_s}\right)^2 I_s \qquad I_{mhs} = 2.01\left(\frac{865}{d_s}\right)^2 I_s$$

where I_{ms} is the mean spherical intensity, I_{mhs} the mean hemispherical intensity, I_s the standard intensity, and d_s the distance from the temporary standard to the photometer screen, this value being recorded on a drum. A single covering on a drum suffices for the record of many tests, and the records may be worked out at the leisure of the operator. Fig. 4 gives a specimen record and shows the usual range of fluctuation. The number of settings here is 30. This large number is necessary because of the fluctuations in the intensity of the arc, even with the steadying effect peculiar to the multiple mirror method. With hand fed arcs a smaller number will suffice to give a value representative of the average performance of the arc. For the distribution curves, it suffices to uncover the mirrors in pairs and make settings in the usual way. The appropriate mirror constants must, of course, be used in working up the results.

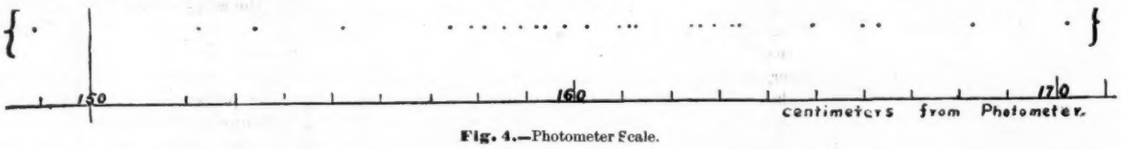


Fig. 4.—Photometer Scale.

As a check on the accuracy of the integrating method as compared with the usual method: The results are given of a test on an arc of the inclosed type. The value obtained from the Rousseau diagram is 308. That by the method described in this paper, 319. This agreement is within 3.4 per cent. When one considers the difficulty in maintaining an automatic feed arc under constant conditions during the time required to take the distribution curve, this must be considered as a very satisfactory agreement.

British Columbian Coal.

Coal and copper are the two minerals which promise to contribute as much as any to the material wealth of British Columbia in the near future. There is cause for satisfaction at the progress made in gold, silver, and lead production; and on the basis of Geological Survey investigations, there is no room to assume that the country has come anywhere near the limits of its capacity in respect of any of the three. The future of coal, at least, is bound up with the advance of mining as a whole. But the possibilities of production of these two seem to be greater than those of the others; and everything points to the likelihood of Canada, chiefly by the aid of British Columbia's contribution, attaining a leading place as a copper producer, with the judicious investment of more capital in its ventures and the erection of more smelters. Scattered here and there about every annual report of the Minister of Mines are references to numerous finds, some at least of which must be capable of profitable developments. One of the latest places to claim attention is Copper Mountain Camp, in the Similkameen district. It is

notorious that very little copper will stain a whole mountain side, but the ore in this locality has been found to be "of great extent." The deposits on Vancouver Island remain virtually untouched, and they, like the ores of Copper Mountain and other points, are far richer in metal than those which have been worked with such success in the Lake Superior district of the United States. The coal fields at present producing are those of Vancouver Island and of the Crow's Nest Pass. The last has been rendered accessible only within the last year by the opening of the Crow's Nest Pass Railway, and in the period under review 206,803 tons were produced, of which 103,231 tons were used for coke making, leaving a net 103,572 tons. In Vancouver the yield was 1,383,376 tons, of which 47,353 tons were used for coke making, leaving a net 1,336,023 tons, and of this 914,183 tons were sent abroad. The Crow's Nest collieries are good for a much greater output than those of Vancouver; but, as we have said, they have only just began serious shipments, and the company working the seams has been suffering from the many inconveniences incident to all new enterprises of this sort, and the property cannot as yet be said to be thoroughly equipped; a matter which is, however, gradually being remedied. The estimates of some engineers place the quantity of coal within this area at 25 billions of tons, which would admit of an output of 25 million tons a year, or 70,000 tons a day for 1,000 years. It is thought, too, that the use of the diamond drill in the valleys will reveal many as yet undiscovered seams.

The coal in the seams exposed up to the present is very uniform and of excellent quality. It is said to be the best coking coal in America, the coke possessing high calorific power and great crushing strength. Although only two important districts have been developed, coal is found in many other parts of the province. Mr. Ronald C. Campbell-Johnston has enumerated the more accessible. To the west, near Fairview, in the Okanagan Valley, he says, there are outlying indications at Swan (or Vaseau) Lake, at Okanagan Falls, up the north fork of the Kettle river, and into the Fire Valley and Okanagan districts around Whauchope. In these discoveries we have the rims of the coal basins cropping out, and boring is now proceeding to locate the deeper parts of the basins. Similar indications appear again to the west, commencing near the southern boundary, at Princeton, in the Similkameen Valley, further north on the Tulameen river, near Otter Flat, at Gulliford's Ranch, Coutree, Nicola, Stump Lakes, North Thompson river, Hat Creek, near the Marble Canon, and to the unexplored north. In the Hazelton district, around Babine and Stewart Lakes, explorations are going on, and surveys for railways are being completed to open up a second Kootenay in all its wealth of coal, copper, lead, silver, and gold. Dr. Dawson predicted this 20 years ago. The coal basins here are said to equal the Crow's Nest basin in quantity and quality. Pending the exploitation of these fields, the Crow's Nest coal will do. The British and American Admiralties are said to have practically proven by hard tests its steam producing powers, and have agreed to substitute it for Welsh coal, on completion of a railway along the Columbia river to Golden, to transmit it to the coast.

British Columbia continues to make striking progress as a mining country. The annual report for last year puts the value of all minerals obtained at $16,344,751, as compared with $12,393,131 for 1899 and $10,906,861 for 1898. On the one twelvemonth there is a slight decrease in placer gold; but this is compensated for by a very substantial increase in lode gold, the total yield being 231,089 ounces, as compared with 205,560 ounces. Silver, too, shows an appreciable improvement — 3,958,175 ounces, comparing with 2,939,413 ounces, the increase being equal to 39 per cent., attributable principally to the activity in Southeast Kootenay, which turned out 960,411 ounces, against 33,516 ounces in the previous year. Over 90 per cent. of the silver production comes from silver-lead ores, and a rise in the quantity of lead obtained was, therefore, a foregone conclusion. The figures under this head, in fact, constitute one of the features of the year, the output being 63,358,621 pounds, as compared with 21,862,436 pounds in 1899. The report says the increase has been brought about "chiefly by the energetic development of two or three mines in Fort Steele Division," although all the lead producing districts, except Ainsworth, have shown a material increase in production. The Slocan Mining Division has heretofore always held first place in the list of lead producers, having an output in 1897 of almost 31,000,000 pounds; and although in 1899 it fell as low as 16,660,910 pounds, it has again increased in 1900 to 19,565,743 pounds, a gain over the previous year of 17 per cent. However, the increase in Fort Steele Division of from 881,167 pounds in 1899 to 38,495,079 pounds in 1890 has earned for it the right to be considered the lead producing center of the province. In copper, also, British Columbia is making striking progress; and though it does not yet count as a factor of great significance in relation to the world's supply, there is no denying its great potentialities. The output was 9,977,080 pounds, in comparison with 7,722,591 pounds in 1889 and 7,271,678 pounds in 1898. The Rossland ores appear to be pinching out – at any rate, the metallic contents are much less than they were. The quantity shipped in the 12 months increased by 26 per cent., but the average yield was no more than 10 pounds per ton, against 33 pounds in 1899; and as a result the copper production was less than half that of the preceding period. The Nelson district also reports diminished shipments, but this is referred to a temporary suspension of shipments by the largest producer, "pending the installation of new machinery and development of the mine." The situation was saved by the appearance in the field for the first time of the Boundary Creek district, which accounted for 5,672,177 pounds, and by the activity among the Coast mines, whose yield was 2,193,962 pounds, an increase of more than 100 per cent. So far, iron counts for nothing in relation to British Columbia's mineral. It is only mined as a flux for lead smelting, and we are told that "the copper and other ores carrying an excess of iron, which have now been discovered, are rapidly replacing this barren flux, with the result that the tonnage of iron ore mined is decreasing," the quantity reported for 1900 being no more than 580 tons. But there is plenty of ore of good class which will no doubt be utilized in time in the establishment of an iron manufacturing industry, in conjunction with the coal of the Crow's Nest Pass and other parts of the province. That time may not be so remote as is thought probable. The report refers to the excitement created over the discovery of deposits of magnetic ore, chiefly in the neighborhood of the Alberni canal. The provincial mineralogist finds that they consist of extensive surface showings of very good magnetic ore. The development work was confined mainly to surface stripping; and while the surface indications were excellent, the depth or performance of the deposits had not been proved by any shaft or sufficient tunnel. Says the writer of the report:

"Before iron ore will attain any value on this coast, it must be proved to exist in sufficient quantity and under such conditions for cheap mining as to justify the establishment of an iron blast furnace and rolling mill. Such a plant requires about 10 years' supply of ore absolutely in sight, and such an amount of ore will never be shown to exist by surface stripping. It is reported, unofficially, that an American syndicate has bonded the properties referred to, and has this past fall sunk shafts and driven tunnels, which continue to give satisfactory showings." This is a very large undertaking, and, as must be expected, work will proceed slowly and cautiously, so that it will be a couple of years yet before sufficient knowledge is obtained of the deposits to justify the establishment of iron works. Still, the enterprise is distinctly one of promise.

[Concluded from Page 572.]

Development of the Nernst Lamp in America.

[A paper read by MR. ALEXANDER JAY WURTS, at the Buffalo Convention of the Am. Inst. Electrical Engineers.]

Explanatory Notes.—The Hefner unit of candle power has been adopted in this paper so that ready comparisons may be made with the results obtained on the Nernst lamp in European countries.

Names of parts in the Nernst lamp: The "glower" is the filament or light giving body. The "ballast" is a steadying resistance connected in series with each glower. The "holder" is the removable piece containing glowers and heaters. The "heater porcelain" is the porcelain disk in the holder immediately back of the heater. The "heater case" is a small glass globe used in the 6-glower and 30-glower lamps.

Performance of the Lamp.—At the present writing, July 15th, there are in operation at East Pittsburg, 73 6-glower lamps, 1 3-glower and 3 single glower; in our laboratory and shop at Allegheny, 40 6-glower, 10 3-glower, and 21 single glower lamps; in the courtyard we have 4 outdoor 6-glower lamps and in the tumbling room of the foundry, 1 outdoor 6-glower lamp, all running on alternating current at 220 volts. In addition to these, there are 14 single glower direct current 110-volt lamps in Mr. Westinghouse's residence, making a total of something like 50,000-candle power in and about Pittsburg. At the Pan-American Exposition, we have lighted the interior of the dome of the Electricity Building by festooning 92 6-glower lamps from a pendant chandelier consisting of a central lamp of 30 glowers and 2,000-candle power encircled with 6 lamps of the 6-glower type; on the floor, variously distributed, there are 12 6-glower, 24 3-glower, and 8 1-glower lamps. These figures are intended to give some idea of the scale on which the Nernst lamp has been developed and the resources which have been placed at our disposal.

Seventeen 6-glower lamps have been running at East Pittsburg for

of smoke may be permanent, the ring of smoked sectors is covered by two plates of plane glass. These plates cover but do not touch the smoked surfaces. The three thicknesses of glass are firmly bound together, and the screen, as a whole, may be handled without fear of changing its absorption. The precaution must be taken to thoroughly clean its external surfaces before making measurements. An essential condition to the success of this method is that the photometer screen should receive through any given sector from the image in the corresponding mirror and from no other. That this condition is fulfilled can easily be determined. Thus, if all the mirrors be covered except the horizontal one, and all the sectors be covered except the sector just above the horizontal, that is, at 15° A, then if the patch of light produced by this arrangement of the apparatus falls not upon the photometer screen, but upon the black surface in the vicinity of the photometer, the required condition is met. The sectored disk is best put in place by replacing the photometer screen by a cardboard pierced by a small opening. The observer can then sight through this hole and ascertain the adjustment of the disk with reference to the system of mirrors.

The mirrors are of good quality, French plate glass. Their reflection coefficients were carefully determined for the incidence at which they are used. Some inequalities were found, as would be expected, although the maximum difference from the mean value of .815 is only + 2.9 per cent. However, in order that the apparatus might be used for the measurement of steady sources, variations of the coefficient were corrected by smoking the corresponding glass sectors. That is to say, if the coefficient of a particular mirror were high, the corresponding glass sector was smoked a little heavier than would otherwise be done.

Some care and skill are necessary to produce a uniform coating of smoke of just the required density. It was found convenient to use a sheet iron chamber, fitted with a suitable flue, and pierced near the top with a small opening for the introduction of the glass. This chamber must be placed near one end of the photometer bar in order that the absorption of the glass may be tested as frequently as may be necessary. The setting of the photometer being predetermined, each sector is smoked until it shows the required absorption. There is a tendency for the coating to form most heavily near the edges of the glass. This may be overcome by providing a guard ring of glass of the same thickness as the piece to be smoked, the whole being mounted in a convenient holder. The best results will be obtained by holding the piece of glass vertically in the smoke chamber, occasionally reversing the piece. Turpentine is a good combustible, but it must be introduced into the receptacle at the base of the chamber in small quantities, otherwise the combustion will be so violent as to produce a flocculent deposit on the glass.

In testing the glasses it is best to use a small source of light, such as a narrow slit in front of a straight filament glow lamp. Any inequalities in the coating of smoke can be detected by moving the glass about in front of this opening, care being taken that the same plane is maintained. It will be seen in Fig. 1 that the incidence of the light upon the glass is not quite normal. Care was taken to maintain this same incidence in the absorption tests.

At M_s is shown a mirror for directing the light from the temporary standard to the photometer. This mirror might have been omitted had not the limits of the photometer room already been taxed to the utmost. Still better, if the mirrors were from one large piece of glass, the direction of the photometer bar might be such that the same incidence would be had on M_s as upon the others. In this case the correction for the mirror absorption would be eliminated.

The illumination upon the arc side of the photometer screen is, of course, very intense. It is necessary to reduce this illumination. For this purpose there was used a rotating wheel W, provided with a large number of narrow radial slots. It is quite essential that the number of open slots should be large, as otherwise the illumination on the photometer screen will be seen to beat or pulsate when measurements are being made on the alternating arc. In order to avoid this the constant of this wheel was determined by direct experiment on the arc itself, and not by calculation. The mean of several determinations gave the transmission constant of the sectored wheel K_w the value of .090. The number of slots in this wheel is 48, which gives a frequency amply great at the normal speed of the motor used for driving the wheel.

A possible source of error is the diffusion of the smoked glass disk. That is to say, since the disk receives a certain flux of light dependent upon the solid angle which it subtends from each image as a center and upon the intensity of such image, it becomes, to some extent, a secondary source. The direct measurement of this is a matter of some difficulty. To determine if the correction for this diffusion were of importance, the longitudinal screen SS' was removed, the mirrors to the left of the vertical were covered, and likewise the right half of the sectored glass disk. With an arc of ordinary intensity in the center of the mirror system, it is evident that the left half of the sectored disk receives a flux of light about equal to that which it would normally receive with the longitudinal screen in position and the mirrors entirely uncovered. At the same time no direct light from the images falls upon the photometer screen. Any illumination perceived under such circumstances would be due to the diffusive action of the glass. As a matter of fact, it was found that with the temporary standard stopped down by a narrow slit, a setting could be obtained in this way when the sectored wheel was not in position, but when this wheel was running in its proper place the correction was entirely negligible. Hence no further attempt was made to take account of it.

The distance from source to photometer screen is large, being nearly 9 meters. As the incidence of the light from the temporary standard is the same as that from the arc, no correction is here necessary.

The paper gives the deduction of the working equation of the apparatus, which, for the particular apparatus described, is as follows:

$$I_{ms} = 1.17\left(\frac{865}{d_s}\right)^2 I_s \qquad I_{mhs} = 2.01\left(\frac{865}{d_s}\right)^2 I_s$$

where I_{ms} is the mean spherical intensity, I_{mhs} the mean hemispherical intensity, I_s the standard intensity, and d_s the distance from the temporary standard to the photometer screen, this value being recorded on a drum. A single covering on a drum suffices for the record of many tests, and the records may be worked out at the leisure of the operator. Fig. 4 gives a specimen record and shows the usual range of fluctuation. The number of settings here is 30. This large number is necessary because of the fluctuations in the intensity of the arc, even with the steadying effect peculiar to the multiple mirror method. With hand fed arcs a smaller number will suffice to give a value representative of the average performance of the arc. For the distribution curves, it suffices to uncover the mirrors in pairs and make settings in the usual way. The appropriate mirror constants must, of course, be used in working up the results.

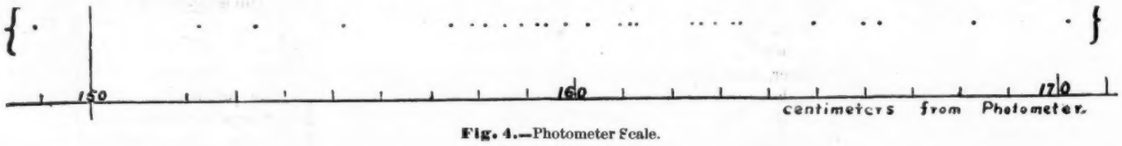


Fig. 4.—Photometer Scale.

As a check on the accuracy of the integrating method as compared with the usual method: The results are given of a test on an arc of the inclosed type. The value obtained from the Rousseau diagram is 308. That by the method described in this paper, 319. This agreement is within 3.4 per cent. When one considers the difficulty in maintaining an automatic feed arc under constant conditions during the time required to take the distribution curve, this must be considered as a very satisfactory agreement.

British Columbian Coal.

Coal and copper are the two minerals which promise to contribute as much as any to the material wealth of British Columbia in the near future. There is cause for satisfaction at the progress made in gold, silver, and lead production; and on the basis of Geological Survey investigations, there is no room to assume that the country has come anywhere near the limits of its capacity in respect of any of the three. The future of coal, at least, is bound up with the advance of mining as a whole. But the possibilities of production of these two seem to be greater than those of the others; and everything points to the likelihood of Canada, chiefly by the aid of British Columbia's contribution, attaining a leading place as a copper producer, with the judicious investment of more capital in its ventures and the erection of more smelters. Scattered here and there about every annual report of the Minister of Mines are references to numerous finds, some at least of which must be capable of profitable developments. One of the latest places to claim attention is Copper Mountain Camp, in the Similkameen district. It is

notorious that very little copper will stain a whole mountain side, but the ore in this locality has been found to be "of great extent." The deposits on Vancouver Island remain virtually untouched, and they, like the ores of Copper Mountain and other points, are far richer in metal than those which have been worked with such success in the Lake Superior district of the United States. The coal fields at present producing are those of Vancouver Island and of the Crow's Nest Pass. The last has been rendered accessible only within the last year by the opening of the Crow's Nest Pass Railway, and in the period under review 206,803 tons were produced, of which 103,231 tons were used for coke making, leaving a net 103,572 tons. In Vancouver the yield was 1,383,376 tons, of which 47,353 tons were used for coke making, leaving a net 1,336,023 tons, and of this 914,183 tons were sent abroad. The Crow's Nest collieries are good for a much greater output than those of Vancouver; but, as we have said, they have only just began serious shipments, and the company working the seams has been suffering from the many inconveniences incident to all new enterprises of this sort, and the property cannot as yet be said to be thoroughly equipped; a matter which is, however, gradually being remedied. The estimates of some engineers place the quantity of coal within this area at 25 billions of tons, which would admit of an output of 25 million tons a year, or 70,000 tons a day for 1,000 years. It is thought, too, that the use of the diamond drill in the valleys will reveal many as yet undiscovered seams.

The coal in the seams exposed up to the present is very uniform and of excellent quality. It is said to be the best coking coal in America, the coke possessing high calorific power and great crushing strength. Although only two important districts have been developed, coal is found in many other parts of the province. Mr. Ronald C. Campbell-Johnston has enumerated the more accessible. To the west, near Fairview, in the Okanagan Valley, he says, there are outlying indications at Swan (or Vaseau) Lake, at Okanagan Falls, up the north fork of the Kettle river, and into the Fire Valley and Okanagan districts around Whauchope. In these discoveries we have the rims of the coal basins cropping out, and boring is now proceeding to locate the deeper parts of the basins. Similar indications appear again to the west, commencing near the southern boundary, at Princeton, in the Similkameen Valley, further north on the Tulameen river, near Otter Flat, at Gulliford's Ranch, Coutree, Nicola, Stump Lakes, North Thompson river, Hat Creek, near the Marble Canon, and to the unexplored north. In the Hazelton district, around Babine and Stewart Lakes, explorations are going on, and surveys for railways are being completed to open up a second Kootenay in all its wealth of coal, copper, lead, silver, and gold. Dr. Dawson predicted this 20 years ago. The coal basins here are said to equal the Crow's Nest basin in quantity and quality. Pending the exploitation of these fields, the Crow's Nest coal will do. The British and American Admiralties are said to have practically proven by hard tests its steam producing powers, and have agreed to substitute it for Welsh coal, on completion of a railway along the Columbia river to Golden, to transmit it to the coast.

British Columbia continues to make striking progress as a mining country. The annual report for last year puts the value of all minerals obtained at $16,344,751, as compared with $12,393,131 for 1899 and $10,906,861 for 1898. On the one twelvemonth there is a slight decrease in placer gold; but this is compensated for by a very substantial increase in lode gold, the total yield being 231,089 ounces, as compared with 205,560 ounces. Silver, too, shows an appreciable improvement — 3,958,175 ounces, comparing with 2,939,413 ounces, the increase being equal to 39 per cent., attributable principally to the activity in Southeast Kootenay, which turned out 960,411 ounces, against 33,516 ounces in the previous year. Over 90 per cent. of the silver production comes from silver-lead ores, and a rise in the quantity of lead obtained was, therefore, a foregone conclusion. The figures under this head, in fact, constitute one of the features of the year, the output being 63,358,621 pounds, as compared with 21,862,436 pounds in 1899. The report says the increase has been brought about "chiefly by the energetic development of two or three mines in Fort Steele Division," although all the lead producing districts, except Ainsworth, have shown a material increase in production. The Slocan Mining Division has heretofore always held first place in the list of lead producers, having an output in 1897 of almost 31,000,000 pounds; and although in 1899 it fell as low as 16,660,910 pounds, it has again increased in 1900 to 19,565,743 pounds, a gain over the previous year of 17 per cent. However, the increase in Fort Steele Division of from 881,167 pounds in 1899 to 38,495,079 pounds in 1890 has earned for it the right to be considered the lead producing center of the province. In copper, also, British Columbia is making striking progress; and though it does not yet count as a factor of great significance in relation to the world's supply, there is no denying its great potentialities. The output was 9,977,080 pounds, in comparison with 7,722,591 pounds in 1889 and 7,271,678 pounds in 1898. The Rossland ores appear to be pinching out – at any rate, the metallic contents are much less than they were. The quantity shipped in the 12 months increased by 26 per cent., but the average yield was no more than 10 pounds per ton, against 33 pounds in 1899; and as a result the copper production was less than half that of the preceding period. The Nelson district also reports diminished shipments, but this is referred to a temporary suspension of shipments by the largest producer, "pending the installation of new machinery and development of the mine." The situation was saved by the appearance in the field for the first time of the Boundary Creek district, which accounted for 5,672,177 pounds, and by the activity among the Coast mines, whose yield was 2,193,962 pounds, an increase of more than 100 per cent. So far, iron counts for nothing in relation to British Columbia's mineral. It is only mined as a flux for lead smelting, and we are told that "the copper and other ores carrying an excess of iron, which have now been discovered, are rapidly replacing this barren flux, with the result that the tonnage of iron ore mined is decreasing," the quantity reported for 1900 being no more than 580 tons. But there is plenty of ore of good class which will no doubt be utilized in time in the establishment of an iron manufacturing industry, in conjunction with the coal of the Crow's Nest Pass and other parts of the province. That time may not be so remote as is thought probable. The report refers to the excitement created over the discovery of deposits of magnetic ore, chiefly in the neighborhood of the Alberni canal. The provincial mineralogist finds that they consist of extensive surface showings of very good magnetic ore. The development work was confined mainly to surface stripping; and while the surface indications were excellent, the depth or performance of the deposits had not been proved by any shaft or sufficient tunnel. Says the writer of the report:

"Before iron ore will attain any value on this coast, it must be proved to exist in sufficient quantity and under such conditions for cheap mining as to justify the establishment of an iron blast furnace and rolling mill. Such a plant requires about 10 years' supply of ore absolutely in sight, and such an amount of ore will never be shown to exist by surface stripping. It is reported, unofficially, that an American syndicate has bonded the properties referred to, and has this past fall sunk shafts and driven tunnels, which continue to give satisfactory showings." This is a very large undertaking, and, as must be expected, work will proceed slowly and cautiously, so that it will be a couple of years yet before sufficient knowledge is obtained of the deposits to justify the establishment of iron works. Still, the enterprise is distinctly one of promise.

[Concluded from Page 572.]

Development of the Nernst Lamp in America.

[A paper read by MR. ALEXANDER JAY WURTS, at the Buffalo Convention of the Am. Inst. Electrical Engineers.]

Explanatory Notes.—The Hefner unit of candle power has been adopted in this paper so that ready comparisons may be made with the results obtained on the Nernst lamp in European countries.

Names of parts in the Nernst lamp: The "glower" is the filament or light giving body. The "ballast" is a steadying resistance connected in series with each glower. The "holder" is the removable piece containing glowers and heaters. The "heater porcelain" is the porcelain disk in the holder immediately back of the heater. The "heater case" is a small glass globe used in the 6-glower and 30-glower lamps.

Performance of the Lamp.—At the present writing, July 15th, there are in operation at East Pittsburg, 73 6-glower lamps, 1 3-glower and 3 single glower; in our laboratory and shop at Allegheny, 40 6-glower, 10 3-glower, and 21 single glower lamps; in the courtyard we have 4 outdoor 6-glower lamps and in the tumbling room of the foundry, 1 outdoor 6-glower lamp, all running on alternating current at 220 volts. In addition to these, there are 14 single glower direct current 110-volt lamps in Mr. Westinghouse's residence, making a total of something like 50,000-candle power in and about Pittsburg. At the Pan-American Exposition, we have lighted the interior of the dome of the Electricity Building by festooning 92 6-glower lamps from a pendant chandelier consisting of a central lamp of 30 glowers and 2,000-candle power encircled with 6 lamps of the 6-glower type; on the floor, variously distributed, there are 12 6-glower, 24 3-glower, and 8 1-glower lamps. These figures are intended to give some idea of the scale on which the Nernst lamp has been developed and the resources which have been placed at our disposal.

Seventeen 6-glower lamps have been running at East Pittsburg for

more than a year, and are now showing an average life of 800 hours per glower. A similar record has been made with 14 6-glower lamps operating in Allegheny for about a year and a half. The 4 outdoor 6-glower lamps have been running every night during the last 12 months through all kinds of weather, and up to the present time have not given a moment's trouble. The 6-glower lamp in the tumbling room of the foundry failed in the cut-out at the end of 1,000 hours owing to the accumulation of a bunch of iron dust on the pole of the cut-out magnet, but a few strokes of a brush removed the difficulty and the lamp was continued in service.

The line service to these lamps has been fairly good for a shop circuit. As a matter of record, however, it was decided to test 4 6-glower lamps on a circuit, having wide voltage fluctuations and to keep a record of the service and the lamp performance. The record follows:

Four 6-glower, 220-volt lamps were run 1,000 hours. The run was continuous with the exception of 3 periods per day of ½ hour each when the lamps were turned off. A record of the voltage was kept with a Bristol recording voltmeter. An inspection of the voltmeter cards show that these may be classified under 3 types. Of the first, there were 15 cards, indicating that the voltage did not rise higher than 229 volts and only remained there for a short period. Of the second type, there were 26 cards, in which the voltage reached a maximum of 232 volts, maintaining this for about 4 hours. Of the third type, there were 4 cards showing a rise of voltage to 237 and remaining at 235 for 5 hours. These cards show that the lamps have been tested on a circuit, pressure of which varies from 4 per cent. below to 7½ per cent. above normal. There were no ballasts or heaters burned out during this run, nor did the lamps receive any attention or give any trouble.

Of the 24 glowers in these lamps—

15 ran	1,000	hours,
6 "	792	"
1 "	580	"
2 "	380	"

making an average of 890 hours.

The 3, 2 and 1-glower 220-volt, alternating current lamps have given equally satisfactory service, but the glowers in the 110-volt alternating current lamp are not quite so uniform in their performance and the same glowers on direct current are comparatively short lived, averaging in the neighborhood of 150 hours; 220-volt glowers, however, on a direct current circuit would last nearly double that time. At East Pittsburg, where a section of the factory about 350 feet long is lighted with 50 6-glower lamps suspended immediately above the traveling cranes, the features which strike me more forcibly than anything else are the beauty of the illumination and the total absence of shadow and flicker so intimately associated with the electric arc illumination in places of this character.

In connection with this topic, it will be interesting to note just what is going on in the lamp during the time of lighting, also during service under varying conditions of line voltage. Referring to Fig. 10, we

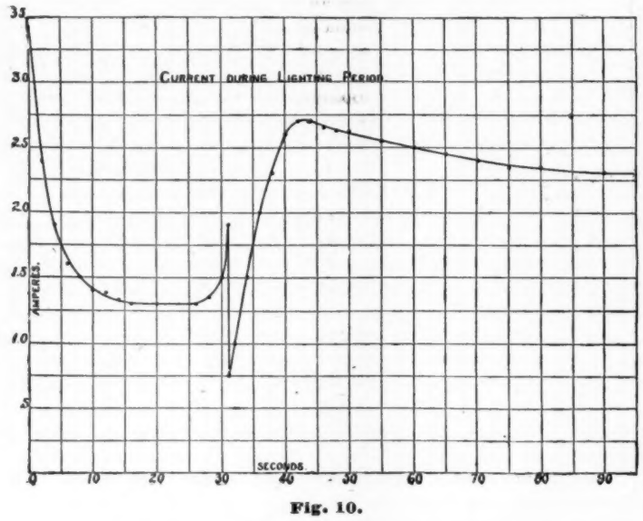


Fig. 10.

have a curve showing the current taken by a 6-glower 220-volt lamp during the lighting period. It will be noticed that as the current is turned on, there is a sudden rush of nearly 3.5 amperes through the heater, which, owing to the temperature correction of the platinum wire, is quickly reduced to about 1.3 amperes. At the end of 26 seconds, the first glower begins to light; at the end of 30 seconds, the second glower is lighted and the heater is cut out, the current dropping at once to .75 of an ampere; the remaining glowers then light rapidly until at the end of 40 seconds all the glowers are lighted. From this point on there is a slight drop in the current until the lamp reaches its normal running temperature.

Referring once more to Fig. 5, we find the current and voltage characteristics of the different elements in the lamp, and above these the characteristics of the lamp itself, the latter being the sum of the cut-out coil, the ballast and the glower. The lamp curve was taken from actual measurements and approximates very closely to the sum of the elements, the slight difference probably being due to some differences

Fig. 11.—Heater Tubes and Glowers.

of temperature. The voltage scale for the cut-out and ballast curves will be found on the right hand side of the diagram; that of the glower and lamp on the left hand side. Your attention is now directed to the excellent characteristic of this lamp, and when we consider the severe conditions imposed by the glower characteristic, I think we are to be congratulated on the results which have been attained. With a normal in the lamp of 2.4 amperes and 220 volts, it will be noticed that an increase of 14 per cent. in voltage causes but a 10 per cent. increase in current, resulting in a comparatively steady light and safe running conditions for the lamp in commercial service. A rise of 25 per cent. in the line voltage would burn out the ballasts in a very short time, but a rise of 10 per cent. for short periods does not seriously affect the life of either glower or ballast; a rise of 5 per cent. may be considered allowable for indefinite periods.

Repair and Maintenance.—When the lamps are first started, they require no attention. After 1,000 hours, however, the renewals become fairly regular and our experience shows an average life of 800 hours for the glowers, 2,000 to 3,000 hours for the heaters and an indefinitely long life for the ballasts. It will, however, be some time before the average life of the heaters and ballasts can be definitely determined. The attention which these lamps receive consists in having the inspector examine the lamps once a week through a colored glass to determine whether or not all 6 glowers are burning. If 2 glowers are out, the lamp is turned off, the holder removed and 2 new glowers inserted; the holder is then returned to its place and the lamp continued in service. Aside from such renewals, these lamps have not given the least trouble.

On the occasion of starting up 50 6-glower lamps at East Pittsburg, one of the engineers, who had had considerable experience with arc lamps, remarked that my troubles would now begin; but, frankly, I think he was mistaken. Aside from the renewal of the perishable parts, I see nothing in the lamp which could possibly cause trouble except under the most extraordinary circumstances. In fact, should a lamp receiving proper attention fail to light, I would look for the trouble elsewhere than in the lamp.

In commercial service it is intended that the central station shall make the renewals in the holders. The customer will be provided with a case containing a suitable number of complete holders, ready for service, so that when a renewal is to be made the customer will simply remove the old holder and insert a new one, such operation consuming but a moment's time; then, at convenient periods, the old holders will be exchanged for new. Where lamps are used in quantity, the renewals will probably be made by the local attendant. The replacing of a ballast requires the removal of the lamp from the circuit; but after that the renewal is easily and quickly made. A slight withdrawal of one screw releases the ballast tube from its socket, whereupon the small aluminum terminal plugs may be withdrawn and the new ballast inserted. This operation does not require any tools other than a pair of small tweezers, and the renewal can be made without returning the lamp to the work bench.

After about 100 lamp hours, the heater case becomes somewhat discolored, and, for first-class maintenance, this should be cleaned at the end of that time. The following instructions for the care and inspection of the Nernst lamps are observed at East Pittsburg:

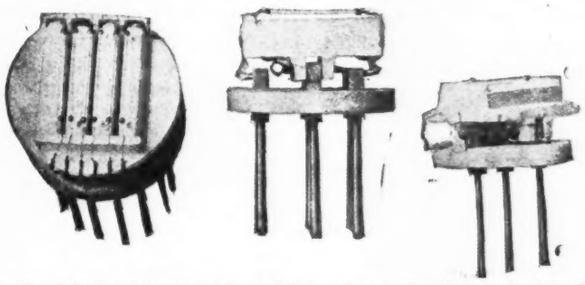


Fig. 12.—Holders for the 6, 2 and 3, and 1-Glower Lamps, Showing an Aluminum Plug Ready to be Inserted.

Inspection of the Lamps.—The lamps should be inspected every 100 lamp hours. After being turned off, the lamp is turned on, and it is noted whether all the heater tubes become bright. If any of the heater tubes are burned out, the holder is replaced by a new one.

If the heaters are intact, the number of glowers burning is determined. If 5 or 6 are burning, the lamp needs no attention.

If less than 6 glowers are burning, the lamp is to be turned off, the holder taken out and the number of broken glowers determined by inspection. If the number of broken glowers is less than the number of glowers that were out, one or more ballasts are out of order and the lamp is to be taken down at once and the defective ballast replaced. When two or more glowers are burned out, the holder is to be replaced by a reserve holder.

Ballasts.—These are supplied in boxes marked "Ballasts for 6-glower lamps," "Ballasts for 1-glower lamps," etc. Burned out ballasts are to be renewed as soon as discovered and may be replaced without taking the lamp to the work bench.

Heater Case.—This receives a coating of platinum black on the inside and should be replaced every 100 lamp hours by a clean heater case. The coating may be removed from the old heater case with a bristle brush running at a high rate of speed. The heater case may then be used over again.

Glowers.—These are supplied in glass tubes marked with the voltage of the lamp for which the glower is intended, thus, "Glowers for 220-volt, 6-glower lamps." Glowers marked for 6-glower, are not to be used in a 3 or 1-glower lamp, and vice versa.

Fig. 13.—Parts of the Single Glower Lamp.

Heaters.—These are wound for 110 volts and are so marked. They are connected two in series for 220 volts. In the 6-glower lamp here are 4 tubes connected in multiple series.

Heater Porcelain.—(This is the porcelain disk immediately behind the heater.) The heater porcelain is given a white coating which becomes fairly red, but can be easily scraped or brushed off when it becomes covered with platinum black. When a holder with a black heater porcelain is removed, the glowers should be taken out, the old coat brushed off, except directly under the heater tubes, and a new coat of "heater porcelain paste" applied. This paste is a white powder which is to be mixed with water and applied with a camel's hair brush. After replacing the heater porcelain and allowing it to dry in the air, run the heater for 2 minutes on 220 volts, placing the holder in a heater case. This hardens the coating, after which the glowers may be replaced.

Cost.—It is too early to say anything definite about the cost of these lamps. Fourteen or fifteen dollars would seem to be a fair price for a 6-glower lamp, other lamps in about the proportion of the number of glowers. It is estimated that the cost of renewals will be considerably less than for inclosed arc lamps.

Provision will be made for the return of the perishable parts containing platinum.

Conclusion.—In closing, let me say that the Nernst lamp can in no sense be considered an experimental device. The development of details connected therewith has continued until all question of doubt as to its commercial success has been removed by the operation of a large number of lamps of various sizes and finished pattern for extended periods under commercial conditions, and it is confidently felt that the splendid exhibit of these lamps, which may be seen at the Pan-American Exposition, will prove a fitting demonstration of the complete and thorough manner in which the brilliant discovery of Dr. Nernst has been taken up and pushed forward in America.

Fig. 14.—30 Glower Lamp, Indoor Type.

Fig. 15.—Single Glower Lamp, Indoor Type

How to Become a Foundry Foreman.

By Mr. A. Frankenheim, in the *Foundry*.

To become a successful foundry foreman requires a knowledge of metallurgy and cupola practice. One must understand the different branches of moulding thoroughly, consisting of green sand, dry sand and loam work, and, above all, the method of handling men, so that their services will be profitable to their employer.

I have come in contact with foremen who were not very good moulders, but they understood the theory of the trade thoroughly. There were far better moulders in the same shop, but these foremen could impart their theoretical knowledge, and in turn give the others a point or two. They could also handle their men to the best advantage, and as they understood the theory of cupola practice, they were quite at home when it came to taking off a heat.

One of these foremen was a very young man, having served his time at pattern making. While working at that trade he would occasionally take a stroll through the foundry and see what was going on, always keeping his eyes and ears open. When any large work was being done he would make sketches and discuss the easiest way to mould it with those working on the job. This young man soon became liked by the moulders, and even by the foreman, for in all his discussions he always spoke intelligently, and his sound opinion was admired by all. I often heard him say that he would become a foundry foreman, and he did.

It is plain that this young man could not have reached such a high standing among his fellow shopmates if it had not been for study. He would purchase books on metallurgy, moulding and cupola practice, and after his day's work in the pattern shop he would study at night and in the cars, as he went to and from the shop, never neglecting his work in the shop.

At present there is a great fault among the majority of moulders in that they will not study the theory of their trade. Somehow I cannot account for it; it is either that they are played out by their day's work, or they are perfectly satisfied with their positions and have no desire to advance.

Even apprentices in the foundry do not seem to care to study, and it is too bad for a young man to thus let his mind grow dull. It is very wrong for a foreman to put an apprentice on too hard work, for it draws the ambition clear out of him, and consequently his future is ruined, if he does not take to study, for this occupies his mind and tends to develop it.

I say for the benefit of apprentices and moulders that they should read scientific books pertaining to their trade. They may be borrowed from most public circulating libraries. But in small towns where they cannot procure such books, they either have to suffer the consequences of doing without them, or they have to purchase them, thus involving considerable expense, though it is money well spent. In some large cities it is difficult to locate a library having them. Some time ago I inquired

at a few of the public circulating libraries why they did not have such books, and the librarian told me that the majority of the population were not interested in such works, and that was the reason they did not have them on hand. I would recommend that large works and foundries purchase a complete set of such books and issue them to the men in their employ. It will certainly be of great benefit to the moulders as well as their employers.

On the other hand, as regards the education of moulders, I have come in contact with some very intelligent men. They have certainly devoted their spare time to study, and have learned mechanical drawing. This subject is very important to a moulder if he wants to better his position. I do not recommend it for the simple sand pounder, who feels content if he has put up 60 or 70 boxes of sash weights for a day's work, and then goes home with a trowel sticking out of his pocket, and thinks he has mastered the art of moulding. Oh, no; it is not for him; it is for those men who strive to get ahead; it is for those who possess ingenuity, integrity, self-reliance and ambition.

For example: There is a large cylinder to be moulded in loam. It is very often the case that the drawing will be shown to the foreman or the moulder on the job. It will fairly rattle these people if they do not understand it, being, as it is, just like Latin or Greek to them; and they would have made better headway on the job if they had never been shown the drawing. On the other hand, if a man who understands drawing worked on the job, he would read it fluently and have his sweep and steam chest set, and would know where every core belonged, while the other fellow would be fussing, tinkering or trying to find out what it all meant.

It will readily be seen that the foreman will like the men who can do a job without bothering him, and so keeping him from devoting his time to the rest of the men in the shop. Mechanical drawing means business, and the moulders who understand it can command higher wages and act as foundry foremen.

In order to gain the goodwill of the men under them, foremen should treat all equally. Do not be too familiar with the men under you; be sharp, firm, and persistent, and show them that you are running the shop and you will always be respected. Do not have any favorites, for this makes the men discontented, and excites a good deal of comment.

Comparative Merits of the Flame and Electric Safety Lamps for Miners.

The *Journal of the Franklin Institute* notes that Mr. H. W. Halboum discusses in a late number of the *Colliery Guardian*, the present status of the miners' safety lamp. Comparing the improved forms of flame safety lamps of the Davy pattern with the electric glow lamp, he advocates the former as being preferable. For this unexpected condition he adduces the following reasons:

The old form of miner's safety lamp was not devised for the purpose of enabling the miner to remain for any length of time with impunity in an explosive atmosphere. The flame of the lamp cannot pass through the gauze and ignite the explosive gas without, but the gas can penetrate within the lamp and burn within the flame chamber. There is where one of the most valuable properties of the Davy and similar lamps is exhibited. The enlargement of the flame by the burning of the entering gas from without gives the miner immediate warning that he has entered a dangerous working, and enables him to leave the dangerous neighborhood and report its condition.

The electric lamp, on the other hand, gives absolutely no indication of the presence of dangerous gases, being completely inclosed and independent of the surrounding atmosphere. It is free from the danger of igniting the mine gases as long as it remains intact, but if broken, is liable to ignite the mixture without warning.

For these reasons Mr. Halboum is an advocate of the most improved forms of the flame safety lamp, such as the Massant or the Maeselar lamp, believing them to be more desirable. To meet this objection brought forward by Mr. Halboum, the advocates of the electric lamp propose the use in addition to it, of a separate indicator for "fire damp" and "choke damp." This, in his judgment, entirely qualifies all the advantages claimed for the new lamp.

He summarizes his comments on the subject in the following argument: "Every practical pitman at the present day will admit that the ordinary type of safety lamp constitutes a safety lamp chiefly because it betrays the character of the outer atmosphere. If an explosive atmosphere is present, we do not want a lamp that will burn, and a man who will attempt to work in such an atmosphere. We want a lamp that will give indications of the presence of such an atmosphere, and a man who is not insane enough to attempt to work in an atmosphere which is lately unfit for respiration."

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE Port Jervis Gas Light Company, the Port Jervis Electric Light Company and the Deerpark Electric Light Company, all of Port Jervis, N. Y., have been merged under the title of the Port Jervis Light, Power and Gas Company. The officers named to manage the long named Company are: Directors, R. H. Beach, C. R. Horn, R. S. Weaver, Benj. Ryall and W. A. Parshall; President, R. H. Beach; Secretary and Treasurer, C. R. Horn; Manager, R. S. Weaver. Of the named officials, Mr. Horn is also Secretary and Treasurer of the Lehigh-Northampton Gas and Electric Company, of Catasaqua, and Mr. Weaver is its Purchasing Agent and Superintendent.

THE contract for the rehabilitation of the gas plant of the Hudson (N.Y.) Light and Power Company has been awarded to Capt. W. H. White.

THE shareholders of the Benton Harbor-St. Joseph (Mich.) Gas Company have presented to Miss Jessie Dickerman a valuable diamond ring in recognition of her "faithful and efficient services" as Manageress of its affairs.

THE Eaton, Cole & Burnham Company, of Bridgeport, Conn., manufacturer on a large scale of brass and iron goods used by gas and electric companies, and by steam users as well, has purchased, on what is known in Bridgeport as the South Avenue Extension, a large tract of land with valuable docking privileges and facilities. It will erect immediately thereon a steel and brick foundry building, 400 feet long by 150 feet wide, together with power plant and buildings for tumbling barrels, cores, pattern storage, tapping department, storage, sorting, shipping, etc. Contracts for the entire work have been let to the Berlin Construction Company, of Berlin, Conn.

MAYOR W. W. FRENCH, of Gloucester, Mass., has formally petitioned the State Board of Gas and Electric Light Commissioners for a hearing, the subject matter of which is to be what he terms the "excessive charges" for gas made by the Gloucester Gas Light Company. His Honor asserts that a charge of $1 per 1,000 cubic feet would be about the right thing. The ruling rate is $1.50 per 1,000 with 20 cents off for prompt payment – within 15 days.

MR. L. A. BAILEY has been appointed Manager of the office business of the Long Beach (Cal.) Gas Company.

DR. J. ANTON CALLENBACH has accepted a responsible position with the United Coke and Gas Company of this city.

THE Springfield (O.) Gas Company has announced to the residents that until further notice it will be unable to supply natural gas to others than those ordinarily known as private consumers.

MR. L. W. SHORES has retired from the service of the Citizens Gas Company, of Kankakee, Ills.

WE understand that Mr. Bascom Parker, who has for some time been operating under leasehold the plant of the Niles (Mich.) Gas Light Company, has purchased a controlling interest in the Warsaw (Ind.) Gas Light and Coke Company.

THE gas supply for Wauwatosa (Wis.) was laid on some days ago.

IT is said that the right to operate a gas works in West Bay City, Mich., has been finally granted to the Hecla Cement and Coal Company. Under the agreement the selling rates are to be: On illuminating account, $1.20 per 1,000; on fuel account, $1 per 1,000. The works are to be finished within 18 months, and the Company is to file a satisfactory bond that it will carry out its pledges.

PAPERS incorporating the Detroit Suburban Gas Company have been filed by Messrs. Chas. M. Wagner and P. L. Quinlan, of Syracuse, N.Y.; J. P. Cowing and M. F. Bramley, of Cleveland, O.; Michael Liebel, of Erie, Pa.; John Ginzel, of Wyandotte, and S. O. Van de Mark, Detroit, Mich. The Company declares that it is organized for the purpose of carrying on the business of gas and electric lighting supply in Delray, Woodmere and Springwells, Mich. Its capitalization is put at $300,000.

AT the annual meeting of the Consolidated Gas Company of the city of Pittsburg, Pa., the officers chosen were: President, James H. Reed; Vice-President, J. D. Callery; Secretary, W. B. Carson; Treasurer, C. J. Braun, Jr.; General Manager, Robert Young; Engineer, John H. McElroy; Auditor, C. S. Mitchell.

If straws indicate the way in which currents are going, it may be forecast that many straws all point to a compromise between the authorities of Topeka, Kas. (as to the readjusting of the gas selling rates), and the Excelsior Coke and Gas Company of that city. Some time ago the authorities passed an ordinance arbitrarily putting the rate at $1 per 1,000 cubic feet, those who used 30,000 cubic feet or over per month to be granted a rebate of 10 cents per 1,000—the Company had been (and for that matter still is) charging an average price of $1.50 per 1,000. Even the authorities seem to have reached the conclusion that the $1 (and under) rate was an unjust one, and the Company, under the conditions, is disposed to make concessions. The outcome of the contest or arbitration will likely be the placing of the gross rate at $1.40, with 15 cents off for prompt payment. Secretary Morgan, and his associates in the Company, are to be congratulated on the stand they took and kept up during this flamboyant attack of Mayor Hughes and "his" City Council.

The Directors of the Toledo (O.) Gas Light and Coke Company have decided to increase the capital stock from $750,000 to $900,000. The new issue is to be offered to the present shareholders *pro rata*, at par. The proceeds will go to the payment of already arranged and contemplated improvements. In the meantime Manager Faben is doing nicely over the work connected with putting the natural gas pipe lines, recently purchased from the city, where they will do the most good.

Mr. Robert T. Allison, of Philadelphia, is informed that the names of the Directors, to serve for the first year in the management of the affairs of the Poughkeepsie (N. Y.) Light, Heat and Power Company, are as follows: William B. Goodwin, Moses Ely and Thomas Kearney, of New York City; and L. H. Wood and G. T. Kirby, of Mount Kisco, N. Y. The capital stock of the concern is put at $500,000.

The Board of Gas and Electric Light Commissioners have assented to an issue of 600 shares of new stock by the Waltham (Mass.) Gas and Electric Light Company. The shares are to be offered to holders of record at the rate of $110 each. The proceeds are to be devoted to the extinguishing of existing debts and to plant extensions.

The regular quarterly dividend of the New Bedford (Mass.) Gas and Edison Light Company, of 1½ per cent., is payable to-morrow.

Gas men who visit Utica, N. Y., should not fail to inspect the handsome show rooms recently arranged by the Charles Millar & Son Company. The rooms are on the Company's office premises, 127–129 Genessee street, Utica, and they reflect great credit on the Company's clever Manager, Mr. L. H. Birdseye.

The following queer advertising notice appeared in the Wilmington (Del.) *Sun*, dated the 7th inst.: "*Caution.*—All parties contemplating underwriting or purchasing securities based upon the property of the Wilmington (Del.) Coal Gas Company are warned to carefully investigate the gas situation in Wilmington before doing so. The Oxy-Hydrogen Gas Company, of Wilmington, Del., is owned by my friends. Its works are practically finished, and it will ultimately lay its pipes in the city of Wilmington. The result will undoubtedly be a prolonged gas war, which will prevent the Wilmington Coal Gas Company from making any net earnings applicable to dividends or interest.—J. Edward Addicks."

Mr. Addicks has other "friends," and many of them, too, who are carefully investigating the gas situations in different places that are staggering under loads of gas "securities" which owe their creation to his well known genius.

We are in receipt of a copy of the booklet recently issued by the D. M. Steward Mfg. Company, of Chattanooga, Tenn. Its title is that of "Center Supports;" its sub-title is that of "Being a Short Treatise on the Art of Standing Up Straight;" and the name of its author is that of "A. Ramrod."

Work on the new holder for the Coatesville (Pa.) Gas Company is well underway. It will be completed by the 1st of December.

The proprietors of the Consolidated Gas and Light Company, of Tiffin, O., have notified the residents that the selling rate for gas has been put at $1 per 1,000 cubic feet. This is equivalent to an advance of 50 cents per 1,000.

The Easthampton (Mass.) Gas Company has voted to sell to the Hampton Mills Company of that place the rights which it has in a gasholder located on the property of the Hampton Company. The holder, which is a small one, was constructed years ago for the better gas supply of the Mills.

President Robert Jemison, of the Birmingham (Ala.) Railway, Light and Power Company, has given notice that, beginning the 1st inst., the net rate for an illuminating supply of gas was put at $1.26 per 1,000 cubic feet, the charge for a supply on fuel account being fixed at $1 per 1,000. He also declares, provided the necessary extensions and changes to the manufacturing plant can be completed by July 1, 1902, that the rate for an illuminating supply will then be put at $1.

The Elyria (O.) Gas and Electric Light Company is proposing to engage in the supply of steam heat throughout that city.

The proprietors of the New Orleans (La.) Lighting Company, as lessees of the New Orleans Gas Light Company, have issued the following notice, which explains itself: "Notice is hereby given to those stockholders who have not as yet deposited their certificates of stock with the United States Safe Deposit and Savings Bank, under the agreement made with H. H. Pearson, Jr., that all certificates of stock must be deposited on or before the 15th of October, 1901, as on that date the books will be closed, and no certificate of stock will thereafter be received or negotiable receipt therefor issued, except upon such terms as this Company may in its discretion hereafter fix."

The proprietors of the Dover, Rockaway and Port Oram Gas Company, of Dover, N. J., have executed a mortgage for $175,000, the Fidelity Trust Company, of Newark, N. J., being named as the Trustee. The bonds are to bear interest at the rate of 5 per cent,, and are redeemable in 20 years.

The Milwaukee Gas Light Company has finally secured from the Chicago, Milwaukee and St. Paul Railroad the real property needed to round out the site upon which its mammoth new works will be built.

A correspondent writing under date of the 5th inst., from Birmingham, Ala., forwards the following: "One night, last week Mr. F. L. Bivings, Secretary and Treasurer of the Birmingham Gas Company, acting in conjunction with the Company's Superintendent, Mr. F. Byron, had an interview with Mr. B. F. Roden, the Company's President. The interview terminated by the inferior officials presenting to their superior officer a handsome gold watch as a time noting recollection of their harmonious relations for several years—owing to a change in the ownership of the Company Mr. Roden retires from its service. Mr. Roden was pretty well nonplussed when the souvenir was placed in his hand, but later on recovered sufficiently to express his appreciation in hearty fashion. His response was hardly like that purporting to be it, as published a day or so thereafter in the Birmingham *News*, a copy of which I inclose you. Evidently the *News* man had fixed it up; but whether so or not, it was a good speech from either the head or heart point of view. Mr. Roden was with the Company since 1889, and there are many other residents of Birmingham than Messrs. Bivings and Byron who regret that he is not longer to be practically identified with its fortunes."

The proprietor of the Le Grand Hotel, of Chicago (and he does not keep a very aristocratic hostelry, either), reports that one of his recent guests (a farmer from Wyoming, Ontario), adopted a decidedly novel means of extinguishing the gas preparatory to retiring for the night. Having tried several methods he at last seized the water pitcher, mounted a chair and "doused the glim." The oddest outcome of his queerly successful attempt was the fact that, after an exposure of several hours (from 11 P.M. of Monday to 5 P.M. of Tuesday) to the gas charged atmosphere of the room he was eventually brought back to consciousness and later on sent forward to Wyoming.

In the course of a recent chapter of "Notes from Scotland" to the *Iron Age* it was said: "What has made considerable impression in our [Scotch] coal markets is the report of sales of American coal at $4.38 per ton, c.i.f. Genoa or other Mediterranean ports. This is just about the present price of best Welsh steam coal, f.o.b. Cardiff. Scotch steam coal is, of course, not so good as Welsh. At present it is obtainable at $2.50 per ton, f.o.b., and freight hence to Genoa can be obtained at $1.50 per ton. This is still cheaper than American coal as far as tonnage is concerned. But how does quality compare? Charters have been reported here of steamers to load coal at Philadelphia and other Eastern ports at $2.50 per ton to Mediterranean ports. This is a very low freight—too low to be continuous, for it must leave a loss on the voyage—but while it lasts a good deal of American coal may be thrown into the heart of Europe. And this is a prospect that our coal owners are facing, although the Welsh coal owners seem rather disposed to close their eyes to it. The report, by the way, that a great combine of Welsh coal owners is in process (as yet unconfirmed) has served to give circulation to a story of combination among Scotch coal owners. There is none, nor is there likely to be one."

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
MANAGER.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No. 32 Pine Street, New York.

The JOURNAL is the official organ of the
NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.
AMERICAN GAS LIGHT ASSOCIATION.
WESTERN GAS ASSOCIATION.
OHIO GAS LIGHT ASSOCIATION.
PACIFIC COAST GAS ASSOCIATION.

TERMS:

SUBSCRIPTION—Three Dollars per annum, in advance. Single copies, 10 Cents.

Notification Respecting Advertising.—Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

MONDAY, OCTOBER 14, 1901.

The Market for Gas Securities.

A good recovery was made in prices for Consolidated gas this week, the closing quotation to-day (Friday) coming in at 218½ to 219. There was fairly brisk trading in the shares, with a decided tendency at the ending toward better prices. There is quite a cry over the "ordinary" quality of gas now being supplied in New York city proper, but a great center cannot always have all things at once. New York wanted underground rapid transit, and the preparations therefor are underway at a great rate. These preparations, however, have so far played "golf" with many of the leading gas mains, with the result that breaks are of daily occurrence, and the outcome of the breaks is an interrupted gas service. To be serious over the affair, the underground construction has been very destroying to the Consolidated Company's distribution system, which fact is regretted by none more than the Company, mainly through the dissatisfaction experienced by its customers.

Brooklyn Union is nominally higher, but it is still far too low, from an intrinsic value standpoint. Peoples, of Chicago, is decidedly better than it was a week ago, and it is certain to go on, if good business should advance it. Baltimore is dull, slow and cheap at the figures. Regarding Bay State, something of interest concerning its creator will be found in our item columns. Washington (D. C.) is 315, bid.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

OCTOBER 14.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	218¼	219
Central Union, Bonds, 5's.	3,000,000	1,000	109	110
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	115	118
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	360	315
" Bonds	1,500,000	1,000	00	102
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co. .. Bonds, 5's	11,000,000	1,000	107¾	108
Northern Union, Bonds, 5's.	1,250,000	1,000	106	108
New York and East River . Bonds 1st 5's	3,500,000	1,000	111	115
" 1st Con. 5's	1,500,000	..	109	111
Richmond Co., S. I.	348,650	50	100	..
" Bonds	100,000	1,000	103	..
Standard	5,000,000	100	130	135
Preferred	5,000,000	100	150	155
Bonds, 1st Mortgage, 5's	1,500,000	1,000	118	..
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	208	215
" " Bonds (5's)	15 000,000	1,000	118	119
Bay State	50,000,000	50	⅜	1
" Income Bonds	2,000,000	1,000	.	75
Binghamton Gas Works	450,000	100	28	30
" 1st Mtg. 5's	509,000	1,000	95	96
Boston United Gas Co.— 1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	4½	6
" " Bonds, 5's	5,250,000	1,000	69	72
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	
Central San Francisco	2,000,000	..	106	108
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati Gas & Elec. Co.	29,500,000	100	104⅛	104¾
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	106	107
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	60	65
Preferred	3,026,500	100	84	86
Consumers, Jersey City Bonds	600,000	1,000	102	103
Consumers, Toronto	1,700,000	50	218	225
Consolidated, Baltimore	11,000,000	100	61⅛	62½
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's.	1,000,000	..	..	..
Equitable, 1st 6's.	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	12	14
" Con. Mtg. 5's	380,000	1,000	79	83
Consolidated G. & E. Co.'s., Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co	4,825,500	50	.	89
" Prior Lien 5's	5,603,000	1,000	99½	100
Detroit Gas Co., 5's	381,000	1,000	89	89½
" Inc. 5's	16,000	100	94	94½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	34	38
Fort Wayne	2,000,000	..	..	.
" Bonds	2,000,000	..	50	54
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	102	104
Hartford	750,000	25	240	250
Hudson County Gas Co., of New Jersey	10,500,000	..	25	..
" Bonds, 5's	10,500,000	..	101	103
Indianapolis	2,000,000	..	60	63
" Bonds, 6's	2 650,000	..	100	..
Jackson Gas Co	250,000	50	65	70
" 1st Mtg. 5's	290,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	91	95
Preferred	2,500,000	100	100	103
Bonds	10,000,000	1,000	..	108½
Lafayette Gas Co., Ind.	1,000,000	100		60
Bonds	1,000,000	1,000	48	55
Louisville	2,570,000	50	110	120
Madison Gas & Elec. Co. " 1st Mtg. 6's	350,000	1,000	102½	108
" 6 per cent. scrip, due 1910	100,000	25	87	89
Montreal, Canada	2,000,000	100	182	184¾
Newark, N. J., Con. Gas Co	6,000,000	..	..	55
Bonds, 6's	4,600,000	..	..	103
New Haven	1,000,000	25	300	325
Nashville Gas Lt. Co.	1,000,000	100	110	..
Oakland, Cal.	2,000,000	..	46	47
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	106¾	107
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	46	46½
St. Paul Gas Light Co.	1,500,000	100	60	63
1st Mortgage 6's	650,000	1,000	82	85
Extension, 6's	600,000	1,000	..	..
General Mortgage, 5's	2,465,000	1,000	86	88
St. Joseph Gas Co. " 1st Mtg. 5's	751,000	1,000	93	96
Syracuse, N. Y.	1,750,000	100	18	22
Bonds	1,612 000	1,000	91	93
Washington, D. C	2,600,000	20	315	320
First mortgage 6's	600,000	..	..	..
Western, Milwaukee. Bonds, 5's	4,000,000	..	107	108½
Wilmington, Del.	600,000	50	232	..

Advertisers' Index.

GAS ENGINEERS. Page

Wm. Henry White, New York City ... 635
Fred. Bredel, Milwaukee, Wis. ... 632
Geo. R. Rowland, New York City ... 638
The Western Gas Construction Co., Fort Wayne, Ind. ... 600
Humphreys & Glasgow, New York City ... 633
American Gas Co., Phila., Pa. ... 622
David Leavitt Hough, New York City ... 632
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 619
Baxter & Young, Detroit, Mich. ... 633
United Gas Improvement Co., Phila., Pa. ... 627
James T. Lynn, Detroit, Mich. ... 632
A. E. Boardman, Brevard, N. C. ... 632
The Jeffrey Manufacturing Co., Columbus, O. ... 630

GAS WORKS APPARATUS & CONSTRUCTION

Continental Iron Works, Brooklyn, N. Y. ... 631
Deily & Fowler, Phila., Pa. ... 616
Kerr Murray Mfg. Co., Fort Wayne, Ind. ... 632
Stacey Mfg. Co., Cincinnati, Ohio. ... 635
Bartlett, Hayward & Co., Baltimore, Md. ... 633
Davis and Farnum Mfg. Co., Waltham, Mass. ... 632
R. D. Wood & Co., Phila., Pa. ... 634
Isbell-Porter Company, New York City ... 634
Fred. Bredel, Milwaukee, Wis. ... 632
United Gas Improvement Co., Phila., Pa. ... 627
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 619
The Western Gas Construction Co., Fort Wayne, Ind. ... 600
Humphreys & Glasgow, New York City ... 633
American Gas Co., Phila., Pa. ... 622
Logan Iron Works, Brooklyn, N. Y. ... 636
Riter-Conley Mfg. Co., Pittsburgh, Pa. ... 635
Baxter & Young, Detroit, Mich. ... 632
G. Shepard Page's Sons, New York City ... 632
James T. Lynn, Detroit, Mich. ... 632
A. E. Boardman, Brevard, N. C. ... 632
Christopher Cunningham, Brooklyn, N. Y. ... 630
The Jeffrey Manufacturing Co., Columbus, O. ... 630
Quintard Iron Works, New York City ... 616
Chas. Creighton & Son, New York City ... 616
The Connersville Blower Company, Connersville, Ind. ... 619

PROCESSES.

Bartlett, Hayward & Co., Baltimore, Md. ... 633
United Gas Improvement Co., Phila., Pa. ... 627
Burdett Loomis, Hartford, Conn. ... 634
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 619
The Western Gas Construction Co., Fort Wayne, Ind. ... 600
Humphreys & Glasgow, New York City ... 624
B. E. Chollar, St. Louis, Mo. ... 616

SCRUBBERS AND CONDENSERS.

R. D. Wood & Co., Phila., Pa. ... 634
Continental Iron Works, Brooklyn, N. Y. ... 634
Logan Iron Works, Brooklyn, N. Y. ... 636
Riter-Conley Mfg. Co., Pittsburgh, Pa. ... 635

TAR AND CARBONIC ACID EXTRACTOR.

The Western Gas Construction Co., Fort Wayne, Ind. ... 600

AMMONIA CONCENTRATORS.

Michigan Ammonia Works, Detroit, Mich. ... 616
American Gas Company, Phila., Pa. ... 622
The Western Gas Construction Co., Fort Wayne, Ind. ... 600

GAS METERS.

John J. Griffin & Co., Phila., Pa. ... 640
American Meter Co., New York and Philadelphia ... 639
Helme & McIlhenny, Phila., Pa. ... 639
D. McDonald & Co., Albany, N. Y. ... 637
Nathaniel Tufts Meter Co., Boston, Mass. ... 638
Maryland Meter and Mfg. Co., Baltimore, Md. ... 638
Metric Metal Co., Erie, Pa. ... 639
Keystone Meter Co., Royersford, Pa. ... 638
Detroit Meter Company, Detroit, Mich. ... 599

PREPAYMENT METERS.

American Meter Co., New York and Philadelphia ... 639
John J. Griffin & Co., Phila., Pa. ... 640
D. McDonald & Co., Albany, N. Y. ... 637
Helme & McIlhenny, Phila., Pa. ... 639
Nathaniel Tufts Meter Co., Boston, Mass. ... 638

GAS AND WATER PIPES.

M. J. Drummond & Co., New York City ... 624
R. D. Wood & Co., Phila., Pa. ... 634
Warren Foundry and Machine Co., New York City ... 624
Donaldson Iron Co., Emaus, Pa. ... 624
Christopher Cunningham, Brooklyn, N. Y. ... 630
Charles Millar & Son Co., Utica, N. Y. ... 624

PIPE WRENCHES.

Atlas Pipe Wrench Company, New York City ... 624

GAS MAIN STOPPERS.

Safety Gas Main Stopper Co., N. Y. City ... 630

GAS TAPPING MACHINES.

George Light, Dayton, O. ... 630
H. Mueller Manufacturing Company, Decatur, Ills. ... 620

GAS COALS.

Perkins & Co., New York City 630
Westmoreland Coal Co., Phila., Pa..... 631
Berwind-White Coal Mining Co., New York and Phila... 634

CANNEL COALS.

Perkins & Co., New York City 630

CONVEYORS.

The Link-Belt Machinery Co., Chicago, Ills..... 624
The Western Gas Construction Co., Fort Wayne, Ind... 600
The Jeffrey Manufacturing Co., Columbus, O..... 630

GAS ENRICHERS.

Standard Oil Co., New York City 631
The Sun Oil Co., Pittsburgh, Pa..... 631

COKE CRUSHERS.

C. M. Keller, Columbus, Ind..... 631
The Jeffrey Manufacturing Co., Columbus, O..... 630

STEAM BLOWER FOR BURNING BREEZE.

H. E. Parson, Brooklyn, N. Y..... 624
The Connersville Blower Company, Connersville, Ind... 619

GAS GAUGES.

The Bristol Co., Waterbury, Conn..... 624

GAS GOVERNORS.

Connelly Iron Sponge and Governor Co., New York City 629
Isbell-Porter Co., New York City..... 634
R. D. Wood & Co., Phila., Pa..... 634

CEMENTS.

C. L. Gerould, Galesburg, Ills 628

RETORTS AND FIREBRICKS.

J. H. Gautier & Co., Jersey City, N. J..... 628
Adam Weber Sons, New York City..... 628
Laclede Firebrick Mfg. Co., St. Louis, Mo..... 617 628
Cyrus Borgner, Phila., Pa..... 628
James Gardner, Jr., Co., Pittsburgh, Pa..... 628
Henry Maurer & Son, New York City..... 628
Baltimore Retort and Firebrick Co., Baltimore, Md..... 628
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 628
Brooklyn Firebrick Works, Brooklyn, N. Y..... 628
Missouri Firebrick Co., St. Louis, Mo..... 628

REGENERATIVE FURNACES.

Bartlett, Hayward & Co., Baltimore, Md..... 633
Fred. Bredel, Milwaukee, Wis..... 622
J. H. Gautier & Co., Jersey City, N. J..... 628
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 628
Adam Weber Sons, New York City..... 628
Laclede Firebrick Mfg. Co., St. Louis, Mo..... 617 628
Missouri Firebrick Co., St. Louis, Mo..... 628

SELF-SEALING MOUTHPIECE DOORS.

Isbell-Porter Co., New York City..... 634
Continental Iron Works, Brooklyn, N.Y..... 634
Logan Iron Works, Brooklyn, N. Y..... 636
R. D. Wood & Co., Phila., Pa..... 634

CHIMNEY CONSTRUCTION.

Adam Weber Sons, New York City..... 628

INCANDESCENT GAS LAMPS.

Welsbach Company, Gloucester, N.J..... 626
General Gas Light Company, Kalamazoo, Mich..... 615
D. M. Steward Mfg. Co., Chattanooga, Tenn..... 621

BURNERS.

C. A. Gefrorer, Phila., Pa..... 621
Wm. M. Crane Co., New York City 621
D. M. Steward Mfg. Co., Chattanooga, Tenn..... 621

LAVA GAS TIPS.

D. M. Steward Mfg. Co., Chattanooga, Tenn 621

STREET LAMPS.

Welsbach Street Lighting Co., New York and Phila..... 626
Thos. T. W. Miner, New York City..... 616

PURIFIERS.

R. D. Wood & Co., Phila., Pa..... 624
Stacey Mfg. Co., Cincinnati, O..... 616

PURIFYING MATERIALS.

Connelly Iron Sponge and Governor Co., New York City 629

VALVES.

Ludlow Valve Manufacturing Co., Troy, N.Y..... 630
R. D. Wood & Co., Phila., Pa..... 634
Continental Iron Works, Brooklyn, N. Y..... 634
The P. H. & F. M. Roots Co., Connersville, Ind..... 633
Isbell-Porter Co., New York City..... 634
The Western Gas Construction Co., Fort Wayne, Ind.... 600
Kerr Murray Mfg. Co., Fort Wayne, Ind. 632
The Kennedy Valve Mfg. Co., New York City..... 621

EXHAUSTERS.

The P. H. & F. M. Roots Co., Connersville, Ind..... 623
Isbell-Porter Company, New York City..... 634
Connelly Iron Sponge and Governor Co., New York City 629
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 632
The Connersville Blower Company, Connersville, Ind... 619

ELECTRICAL APPARATUS.

Wm. Henry White, New York City..... 635

ENGINES AND BOILERS.

The Hazelton Boiler Company, New York City..... 620

PURIFIER SCREENS.

John Cabot, New York City..... 624

GAS STOVES.

American Meter Co., New York and Philadelphia..... 625
Maryland Meter and Manufacturing Co., Baltimore, Md. 638
Keystone Meter Co., Royersford, Pa..... 638
Nathaniel Tufts Meter Co., Boston Mass..... 638
George M. Clark & Co,, Chicago, Ills..... 618
Detroit Stove Works, Detroit-Chicago..... 616
Wm. M. Crane Co., New York City 618

GASHOLDER TANKS.

J. P. Whittier, Brooklyn, N. Y..... 633

GASHOLDERS.

Bartlett, Hayward & Co., Baltimore, Md..... 633
Continental Iron Works, Brooklyn, N. Y..... 634
Deily & Fowler, Philadelphia, Pa..... 636
Davis & Farnum Mfg. Co., Waltham, Mass..... 632
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 632
Stacey Mfg. Co., Cincinnati, Ohio..... 635
R. D. Wood & Co., Philadelphia, Pa..... 634
Logan Iron Works, Brooklyn, N Y..... 636
Riter-Conley Mfg. Co., Pittsburgh, Pa..... 633

STORAGE TANKS.

Christopher Cunningham, Brooklyn, N. Y..... 620

AUDITORS AND ACCOUNTANTS.

The J. Dobson Good Audit Company, New York City.. . 616

INVESTORS.

W. R. Faben Construction Company, Toledo, O.. 615

BOOKS, ETC.

Newbigging's Handbook..... 638
Field's Analysis, 1899..... 636
Gas Flow Computers..... 631
Gas Engineer's Laboratory Handbook..... 629
Excerpts from Reports of Gas Commissioners..... 639
Directory of Gas Companies..... 635
Practical Hints on Regenerator Furnaces..... 629
Coal Tar Tree..... 576
Chemistry of Illuminating Gas..... 634
Gas Engineer's Pocket-Book..... 628
Poole on Fuels..... 637
Practical Photometry..... 624
Practical Handbook on Gas Engines..... 637
Hughes' "Gas Works"..... 631
Binders..... 631

DIVIDEND NOTICE.

OFFICE OF THE UNITED GAS IMPROVEMENT CO.,
N. W. CORNER BROAD AND ARCH STS.,
PHILADELPHIA, PA., Sept. 11, 1901.

The Directors have this day declared a quarterly dividend of 2 per cent. (one dollar per share), payable Oct. 15th, 1901, to stockholders of record at the close of business, Sept. 30. Checks will be mailed.

1871-5 LEWIS LILLIE, Treasurer.

POSITION WANTED
AS SUPERINTENDENT,

By a young man, thoroughly experienced in all branches pertaining to the gas industry. Has been very successful in handling new business. Would like to hear particularly from companies desirous of effecting a saving in their manufacturing departments. Energetic and capable. Excellent references. Address, "UP-TO-DATE,"

1874-2 Care this Journal.

FOR SALE, CHEAP.

Four Purifiers, 6 feet by 8 feet by 3 feet 6 inches, for 8-inch connections.
Ironwork, Complete, for four benches of 8's.
Mouthpieces and Lids for two benches of 6's.
One Air Condenser.
One Square Scrubber.
One Station Meter, 4 feet by 4 feet.

All in good condition.
Address, CUMBERLAND GAS LIGHT CO.,
1864-tf Cumberland, Md.

IN THE MARKET.

WE PURCHASE:

Gas properties.
Electric light properties.
Street railway properties.
Also desirable franchises.

W. R. FABEN CONSTRUCTION CO.,
1367-3m 317 St. Claire Street, Toledo, O.

Situation Wanted
By a Superintendent of Many Years' Experience

In the manufacture and distribution of gas, laying mains and services, handling gas stove trade, repairing and setting meters, and all work pertaining to the business. Best of references. Address, "C. R.,"

1869-tf Care this Journal.

INTERNATIONAL GAS EXHIBITION, CRYSTAL PALACE, LONDON, ENGLAND, DEC. 14 TO JAN. 11, 1902.

A firm of well known Gas Engineers, having the management of the above, would be pleased to represent foreign firms of standing (permanent agency) dealing in gas lighting, heating, cooking and gas works plant and machinery; also, recent inventions. Large connection with gas engineers. References required and given. Also, for plans, prospectus and list of patrons of above exhibition, apply direct. HERSEY & LAPTHORNE, Engineers,

1875-1 49 Victoria St., Westminster, London.

THIS IS THE

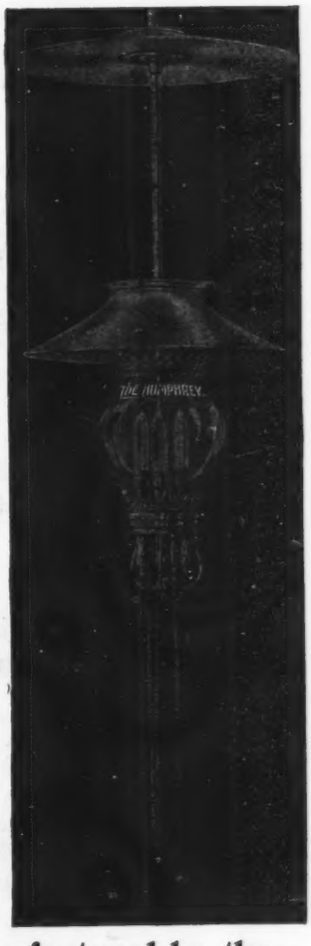
HUMPHREY GAS ARC LIGHT,

The Best Light in the World

FOR LIGHTING

Stores, Churches, Halls or any large indoor areas.

Guaranteed to give a greater volume of light, better diffused and steadier, than an electric arc.



A Complete Revolution in Gas Lighting.

A sample lamp sent on 30 days' trial to any Gas Company.

Manufactured by the

General Gas Light Co.,

KALAMAZOO, MICH.

INVENTIONS FOR EUROPE.

Engineers of standing and acquaintance in Europe are desirous of securing the handling of some good inventions abroad. We want such as will justify the organization of companies. Liberal propositions for the right articles.

ZERBE & ZERBE, Engineers,
1345-tf 11 Broadway, New York.

THE J. DOBSON GOOD AUDIT CO.,
PUBLIC ACCOUNTANTS AND AUDITORS.
Accounts of Mercantile Firms, Banks, Railroads, Gas and Electric Companies, Executors, Trustees, Assignees, Receivers and Corporations, thoroughly and confidentially examined and reported upon.
Special Books Planned & Opened for Gas & Electric Co's.
Telephone, 4345 Cortlandt. } 128 Broadway,
Cable Address, "Bevel," New York } NEW YORK.

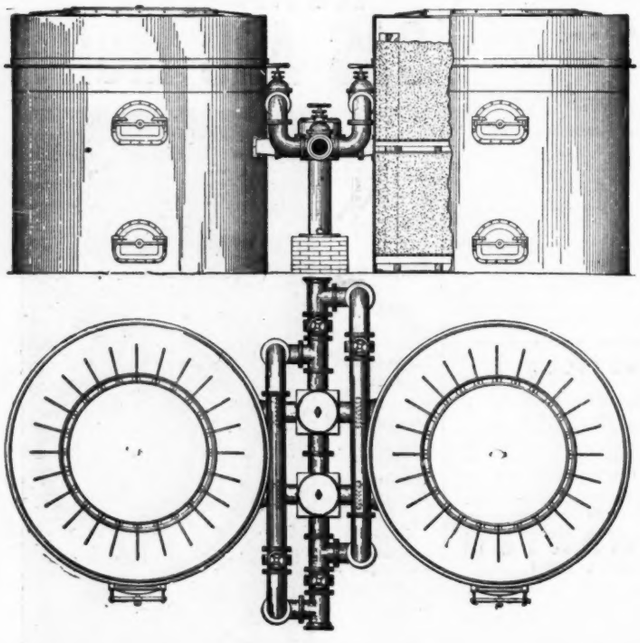
Utilize Your Gas Liquor.
NO EXTRA LABOR OR OPERATING EXPENSES.
Ammonia Concentrator.
Not Expensive. Write to
STROH & OSIUS, Pat'ees, or
Mich. Ammonia Works, Detroit, Mich.

QUINTARD IRON WORKS,
N. F. PALMER,
Foot of 12th St. & East River, New York,
MANUFACTURERS OF
GAS APPARATUS.
Complete Works Erected.
FREDERICK W. FLOYD, Engineer.

CHAS. CREIGHTON & SON,
IRON WORKS.
GAS DEPARTMENT,
JAS. R. FLOYD, Sr., Manager.

WORKS: 155th St., 8th Ave., Harlem River. Telephone, 218 Highbridge.
Office of JAS. R. FLOYD, Sr.: 241-243 West 23d St. Telephone, 3260 Eighteenth St.

"THE MINER"
Globe
Street and Boulevard
Lamps.
Cheapest and Best.
THOUSANDS IN USE WITH INCANDESCENT BURNERS.
Send for Catalogues.
THOMAS T. W. MINER,
821-823 Eagle Av., N.Y.



Chollar's System of Gas Purification.
THE PURIFIED GAS REVIVES THE FOULED OXIDE.
Patented in UNITED STATES, CANADA, GREAT BRITAIN, FRANCE, BELGIUM, GERMANY, AUSTRIA AND HUNGARY.

NOTICE TO GAS COMPANIES!

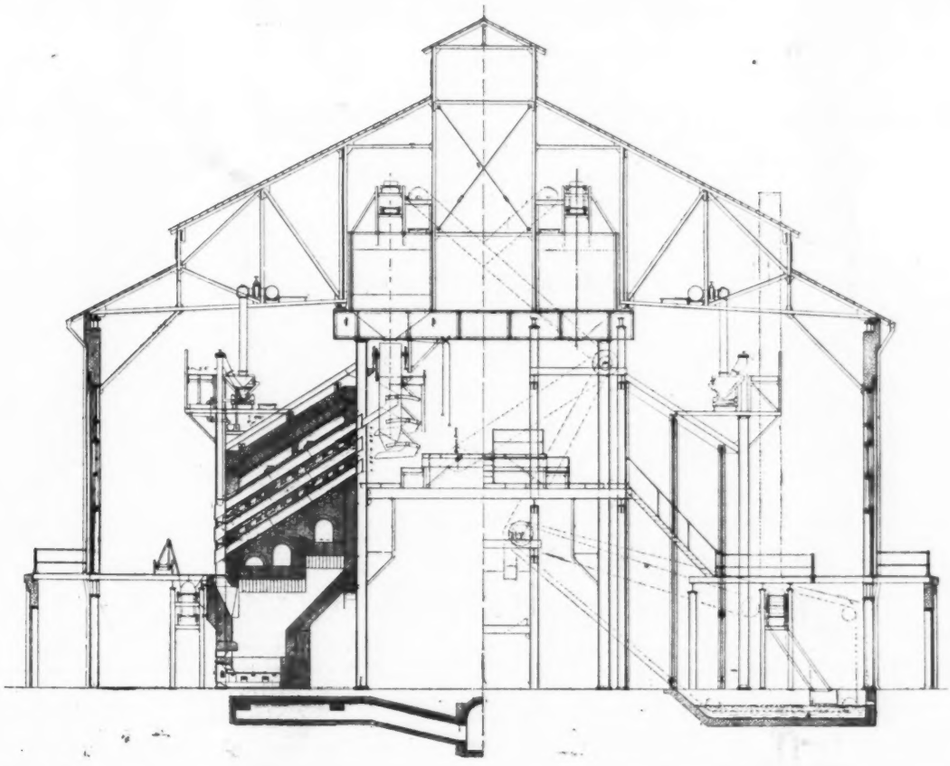
The unauthorized use of any system or method of purification, whereby gas mingled with oxygen is made to flow in one general direction through the purifying mass, and then made to flow through the mass in a directly opposite direction, infringes the above patents!

For Estimates Write
The Stacey Mfg. Co.,
SOLE MANUFACTURERS,
CINCINNATI, O.

DETROIT JEWEL GAS RANGES.
JEWEL STOVES AND RANGES
DETROIT STOVE WORKS
LARGEST STOVE PLANT IN THE WORLD
A Complete, Well Advertised Line; Low Prices and Good Workmanship.
Please Write for Catalogue.
DETROIT STOVE WORKS.
Detroit - Chicago.

ECONOMY IN COAL GAS MANUFACTURE.

THE COZE SYSTEM.



INCLINED GAS BENCHES.

WITH THIS SYSTEM

THE COST OF MAKING COAL GAS IS MATERIALLY REDUCED BY ECONOMICAL HANDLING OF COAL AND COKE. IN A MEDIUM SIZED WORKS OVER 50 PER CENT. IS SAVED, AND EVEN THE SMALLER PLANTS CAN BE OPERATED AT A MUCH LESS EXPENSE THAN BY ANY OTHER METHOD.

COZE PATENTS ARE OWNED BY THE

LACLEDE FIRE BRICK MANUFACTURING CO.

THIS COMPANY

IS THE OLDEST MANUFACTURER OF GAS RETORTS IN THE UNITED STATES, AND REFERS TO SUPERINTENDENTS OF GAS WORKS GENERALLY AS TO THE MERITS OF THE LACLEDE HORIZONTAL AND INCLINED BENCHES AND SETTINGS.

OUR CLAY STANDS EVERY TEST FOR STRENGTH AND DURABILITY.

LACLEDE FIRE BRICK MANUFACTURING CO.,

915 WAINWRIGHT BUILDING,

ST. LOUIS, MO., U. S. A.

THE "VULCAN" CYLINDER HEATERS.

Our New Catalogue No. 20 has been mailed. Did you get your copy? . .

GAS CONTROLLERS,
GAS FITTINGS,
GAS TUBING.

No. 262.—Handsome in appearance and economical in use. Finished in black or antique copper. Height 28 inches, diameter of cylinder 7 inches.

No. 270.—Fitted with improved star burner. Cast open pattern top and base. Height 20 inches, diameter of cylinder 7 inches.

We make ALL KINDS OF GAS APPLIANCES. USE THE "VULCAN" BRAND OF TUBING. It's the best.

WILLIAM M. CRANE COMPANY,
1131-1133 Broadway, New York.

FOUNDRY: PEEKSKILL, N. Y.

New England Agents, Nathaniel Tufts Meter Co., Boston, Mass.

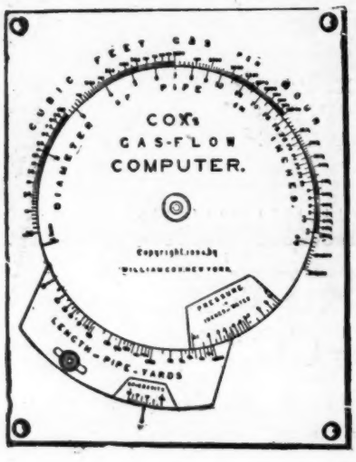
PRACTICAL PHOTOMETRY,

A GUIDE TO THE STUDY OF THE MEASUREMENT OF LIGHT.

By WILLIAM JOSEPH DIBDIN.

With Numerous Illustrations. Price, $3.00.

A. M. CALLENDER & CO., 32 Pine Street, New York City.



Do you wish to Know

what size of Pipe to use to convey any quantity of Gas, any distance, with any loss of pressure, and any initial or final pressure? Then use

COX'S GAS FLOW COMPUTER,

as it gives this information accurately at sight, without mental effort. No calculations needed. Saves time, money and mistakes.

Price, 6.5 x 8 inches, in cloth case, $2.50.

For sale by

A. M. CALLENDER & CO., 32 Pine St., N. Y. City.

W. H. PEARSON, Prest. W. H. PEARSON, Jr., Vice-President. J. T. WESTCOTT, M.E., Manager. L. L. MERRIFIELD, M.Inst.M.E., Chief Engineer.

THE ECONOMICAL GAS APPARATUS CONSTRUCTION CO., LD.

American Offices: 269 FRONT STREET, EAST, TORONTO, ONT.
London Offices: 19 ABINGDON STREET, WESTMINSTER, S.W.

Telegraphic Address: "CARBURETED LONDON AND TORONTO."

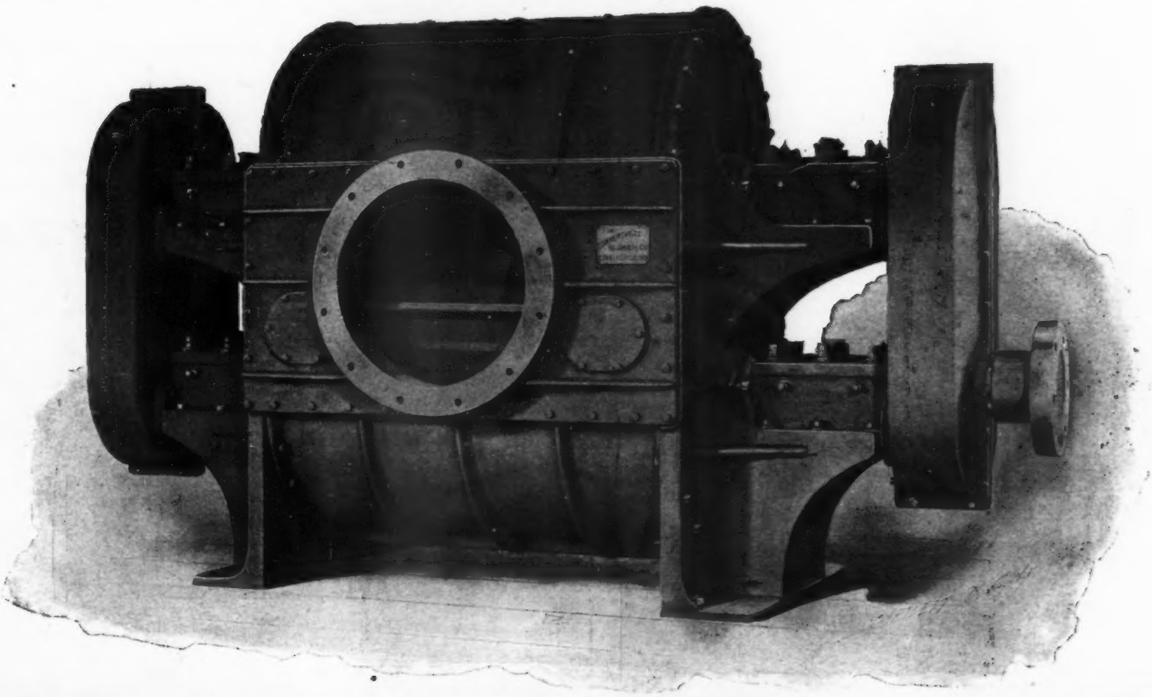
The above Company have erected since 1893, or are now erecting, their universal type of Carbureted Water Gas Plants at the following Gas Works:

	Cubic Feet Daily.
Blackburn, England	1,250,000
Windsor Street Works, Birmingham, England	2,000,000
Saltley Works, Birmingham, England	2,000,000
Colchester, England	300,000
Birkenhead, England	2,250,000
Swindon (New Swindon Gas Company), England	120,000
Saltley Works, Birmingham, England (Second Contract)	2,000,000
Windsor Street Works, Birmingham, England (Second Contract)	2,000,000
Halifax, England	1,000,000
Toronto	250,000
Ottawa	250,000
Toronto (Second Contract, Remodeled)	2,000,000
Lindsay (Remodeled)	125,000
Belleville	250,000
Ottawa (Second Contract)	250,000
Brantford (Remodeled)	200,000
St. Catherine's (Remodeled)	250,000
Kingston, Pa.	125,000
Montreal	500,000
Peterborough, Ont.	250,000
Wilkesbarre, Pa.	750,000
St. Catherine's (Second Contract)	250,000
Buffalo, N. Y.	2,000,000
Winnipeg, Man.	500,000
Colchester, England (Second Contract)	300,000
York, England	750,000
Rochester, England	500,000
Kingston, Ont.	300,000
Crystal Palace District, England	2,000,000
Duluth, Minn.	300,000
Caterham, England	150,000
Enschede, Holland	150,000
Leicester, England	2,000,000
Buenos Ayres (River Platte Co.)	700,000
Burnley, England	1,500,000
Kingston-on-Thames, England	1,750,000
Accrington, England	500,000
Tonbridge, England	300,000
Stretford, England	500,000
Oldbury, England	300,000
Saltley Works, Birmingham, England (Third Contract)	2,000,000
York, England (Second Contract)	750,000
Rochester, England (Second Contract)	500,000
Newport, Monmouth, England	250,000
Todmorden, England	500,000
Tokio, Japan	1,000,000
Nelson, British Columbia (Complete Gas Works). Orders received in 1901 to March 1, 3,500,000 cu. ft. daily.	
Malton, England	150,000
Smethwick, England	500,000

THE CONNERSVILLE BLOWER CO.,

MANUFACTURER OF

ROTARY POSITIVE PRESSURE GAS EXHAUSTERS, BLOWERS AND PUMPS.



HORIZONTAL OR VERTICAL, IN CAPACITY RANGING FROM 9,000 to 1,800,000 CU. FEET DISPLACEMENT PER HOUR.

CONNERSVILLE BLOWER CO., Connersville, Ind. EASTERN SALES OFFICE: 95-97 Liberty St., New York City.

CHRISTOPHER CUNNINGHAM,

PROPRIETOR,

THE NOVELTY STEAM BOILER WORKS,

BROOKLYN, N. Y.

STORAGE TANKS FOR GAS WORKS,

To Retain Fluid Material of Any Sort.

PIPING IN AND AROUND GAS WORKS.

Work Done for Several of the Largest Gas Companies in America Stands as Reference.

HAZELTON WATER TUBE
HIGH PRESSURE BOILERS.

Capacity, Durability,

The Pioneer Vertical Water Tube Boiler of the World.

High quality and durability of the Tubes, the Most Vital Part of a Boiler.

Fastened at One End Only, expand and contract without Strain, Averting any Possibility of Leakage.

10 to 25 per ct. saving over other Boilers.

Safety, Economy.

Stacks, Tanks and Miscellaneous Metal Work.

The Hazelton Boiler Company

Sole Proprietors and Manufacturers,

120 Liberty St., N. Y.

Cable Address, "Paila," N. Y.

Telephone, 4124 Cortlandt.

The Gas Engineer's Laboratory Handbook.

BY JOHN HORNBY, F.I.C. Price, $2.50.

A. M. CALLENDER & CO., 32 PINE ST., N. Y. CITY.

B-109.

IT'S IMMATERIAL

Who pays for the service connection, you or your customer. It is a waste of opportunity, if nothing else, to neglect to use a

B-109 MUELLER MACHINE,

Being a special attachment to prevent escape of gas while tapping. Beats soap.

H. MUELLER MFG. COMPANY,

DECATUR, ILLS.

THE

Ludlow Valve Mfg. Co.,

TROY, N. Y., U. S. A.

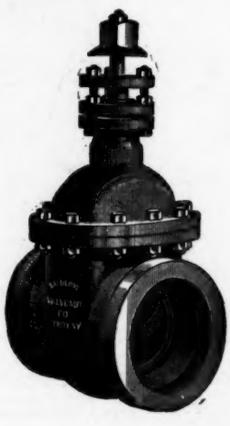
Double and Single Gate Valves, ¼" to 72",

—FOR—

Gas, Water, Steam, Oil, Ammonia, Etc.

HOT GAS VALVES A SPECIALTY.

Send for Catalogue.



STEWARD SAYS

"ALWAYS STAND UP STRAIGHT"
ALAVA
"ALWAYS STAND UP STRAIGHT"

ADVANTAGES.

That every "ALAVA" CENTER-SUPPORT cap mantle is guaranteed to be everything that is claimed for it. . . . . .

The Best that money and skill can produce. . . . .

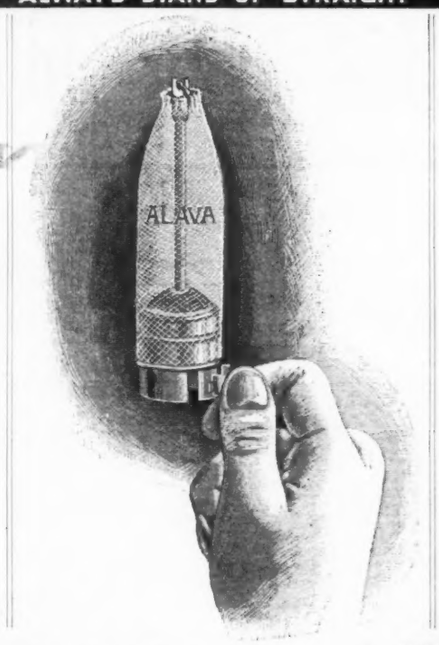
SELLERS ARE AUTHORIZED

To refund purchase price to any dissatisfied buyer. . .

Special terms and advertising inducements will be made to GAS COMPANIES or DEALERS of good standing. . . .

REMEMBER:

"THE EARLY BIRD," Etc.



ALAVA Saves mantles because it cannot bend over. . . . . .

ALAVA Saves chimneys because it always stands up straight. .

ALAVA Reduces vibration. . . .

ALAVA Is easier to put on lamps.

ALAVA Obstructs NONE of the light.

THESE RESULTS ARE GUARANTEED.

We have been making strictly High-Class E. H. Lava Tips and the Popular STEWARD BURNERS since 1876. Our successes in the past are a criterion of the future.

D. M. STEWARD MFG. CO.

GENERAL OFFICE AND WORKS:
CHATTANOOGA, TENN.
NEW YORK: 107 Chambers Street.

To Gas Companies.

We make to order **CAP BURNERS** to burn any amount under a stated pressure. Send for samples.

Also SERVICE CLEANERS, DRIP PUMPS, and STREET MAIN PROVING APPARATUS.

C. A. GEFRORER,
248 N. 8th St., Phila., Pa.

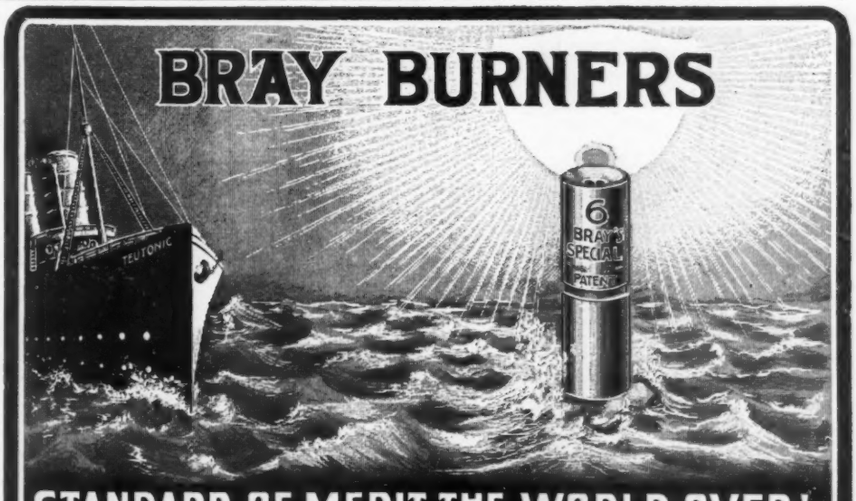
ALL IRON AND BRASS MOUNTED Valves for Gas.

MANUFACTURED BY
THE KENNEDY VALVE MFG. CO.,
WORKS: COXSACKIE, N. Y.
SALES OFFICE: 68 BEEKMAN ST., N. Y. CITY.

A Large Assortment Carried at our New York Warehouse.

REASONABLE PRICES.
GOOD QUALITY.
PROMPT DELIVERY.

BRAY BURNERS



STANDARD OF MERIT THE WORLD OVER!

WILLIAM M. CRANE COMPANY,
SOLE AGENTS FOR UNITED STATES.
1131-1133 BROADWAY, NEW YORK.

TRADE PAPER ADV. AGENCY N.Y.

THE GAS ENGINEER'S POCKET-BOOK,
By HENRY O'CONNOR,
Comprising Tables, Notes and Memoranda relating to the Manufacture, Distribution and Use of Coal Gas, and the Construction of Gas Works.
PRICE, - - $8.50.
A. M. CALLENDER & CO., 32 Pine Street, New York City.

AMERICAN GAS COMPANY

Constructors of Coal Gas Apparatus.

EASTERN AGENTS FOR

BREDEL'S SYSTEM
COAL GAS PLANTS AND GAS APPARATUS.

P. H. & F. M. ROOTS CO.'S
Exhausters, Governors, etc.

GENERAL AGENTS FOR

BRONDER'S CHARGING AND DISCHARGING MACHINES.

AMERICAN GAS COMPANY,

222 South Third Street, Philadelphia, Pa.

FRED. BREDEL, C.E.

Coal and Water Gas Plants.

OWN SYSTEM.

RECUPERATIVE FURNACES, WASHERS, CONDENSERS, PURIFIERS, PURIFYING MACHINES, COKE CONVEYERS, ETC.

SOLE UNITED STATES AGENT FOR
ARROL-FOULIS MECHANICAL CHARGING AND DRAWING MACHINES.

Gas Enriching Plants to Enrich Coal Gas up to 24 Candle Power, and Making a White, Bright, Non-smoking Gas.

GAS RETORTS AND SPECIAL BLOCKS AND FIREBRICK MANUFACTURED UNDER THE SUPERINTENDENCE OF MY OWN CHEMIST.

COMPLETE GAS WORKS

No. 118 Farwell Avenue, · Milwaukee, Wis.

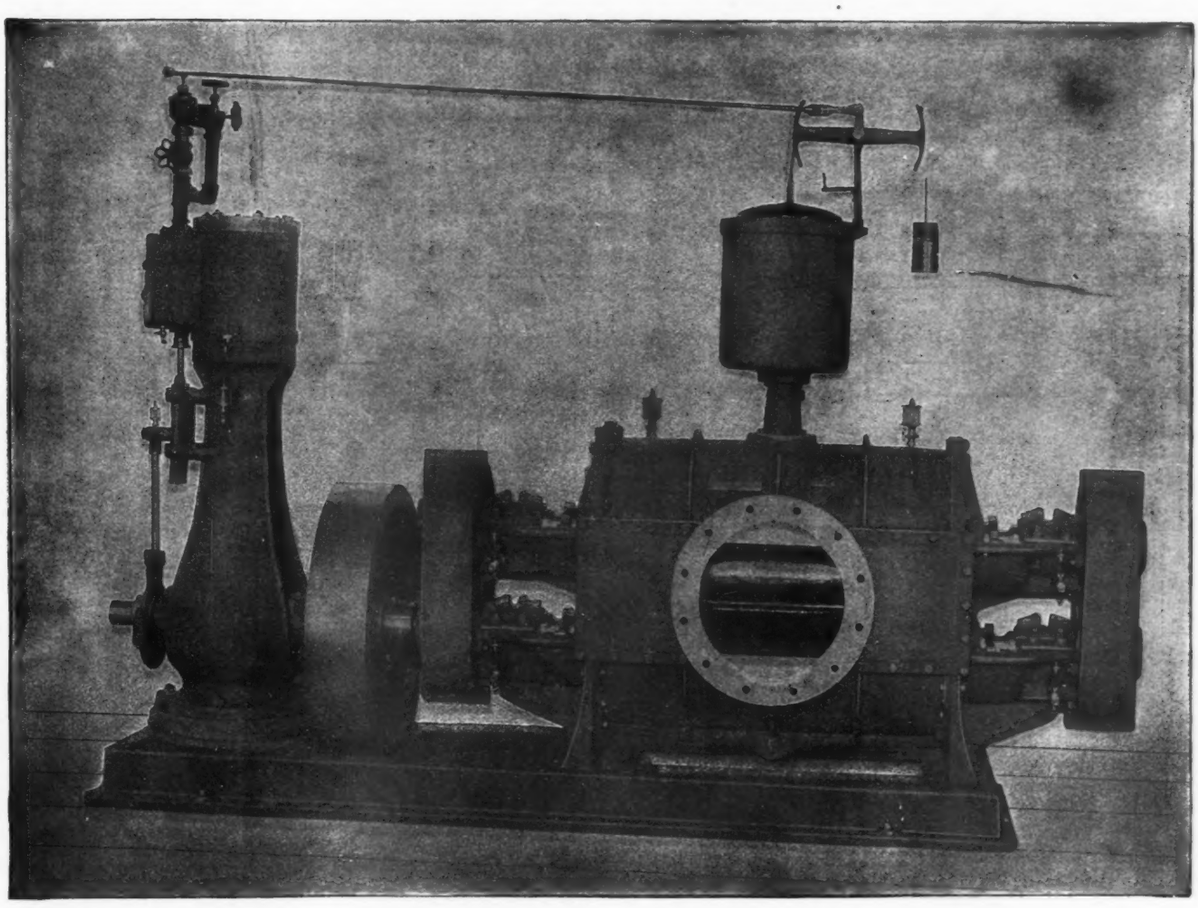
Eastern Agents: AMERICAN GAS CO., Construction Department, 222 So. 3d St., Phila., Pa.

ROOTS'

NEW GAS EXHAUSTER.

Always in the lead. Always anticipating the requirements of the trade. Our new Exhauster meets all demands of modern gas making and overcomes all difficulties heretofore experienced.

OUR GAS GOVERNOR IS MAKING FRIENDS EVERY DAY.



P. H. & F. M. ROOTS CO.,

Connersville, Ind. **109 Liberty St., New York.**

Eastern Office:

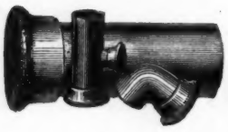
American Gas Company,

222 South Third Street, Philadelphia, Pa.

WARREN FOUNDRY AND MACHINE CO.,

Established 1856. Works at Phillipsburgh, N. J.

New York Office, 160 Broadway.



CAST IRON WATER AND GAS PIPE,

From Three to Forty-Eight Inches Diameter. Also, all Sizes of

Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc.

THREE SLOTS.

THE 3-SLOT ADJUSTMENT of the **ATLAS PIPE WRENCH** is the simplest and most effective adjustment of any **PIPE WRENCH** manufactured. No exasperating delays caused by threads or nuts being burred, rusted or clogged with dirt. **THE SLOT ADJUSTMENT SAVES ALL THAT TROUBLE.** The "ATLAS" grips the pipe quickly and positively, and releases readily

IT NEVER LOCKS.

Made in four sizes: 10-inch, 18-inch, 24-inch and 36-inch, handling everything from ¼-inch wire to 4½-inch pipe. Write for descriptive folder and price list. Ask your Supply Man for the "ATLAS."

——Manufactured by——

ATLAS PIPE WRENCH CO., 121 Liberty St., New York. 51 Flood Building, San Francisco, Cal.

CHARLES MILLAR & SON CO., Selling Agents, Utica, N. Y.

Flanged Pipe and Fittings, Hydrants, Gates, Pig Lead, Jute, etc.

UTICA PIPE FOUNDRY CO.

Manufacturers of Lead Pipe, Solder, etc., and Jobbers of Plumbers' and Tinners' Goods.

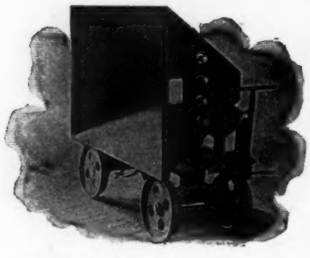
CAST IRON PIPE and SPECIALS FOR WATER AND GAS

Wholesale Eastern Agents AKRON VITRIFIED SEWER PIPE.

THE LINK-BELT MACHINERY CO.,

ENGINEERS, FOUNDERS, MACHINISTS,

Chicago, U. S. A.



Tilting Coal and Coke Car.

LINK-BELT ELEVATING & CONVEYING MACHINERY for HANDLING COAL, COKE, OXIDE, ETC.

Tilting Coal and Coke Cars, Breaker Rolls, Power Transmitting Machinery.

Machinery designed and erected to suit existing conditions and available space.

CATALOGUE UPON APPLICATION

PHILADELPHIA, LINK-BELT ENGINEERING CO.

Parson's Steam Blower

FOR IMPROVING BAD DRAUGHT IN BOILERS, AND FOR BURNING BREEZE OR OTHER WASTE MATERIAL.

PARSON'S TAR BURNER.

FOR USING COAL TAR AS FUEL.

PARSON'S AIR JET TUBE CLEANER,

FOR CLEANING BOILER TUBES.

These devices are all first-class. They will be sent to any responsible party *for trial.* No sale unless satisfactory. Manufactured by the WATERTOWN STEAM BLOWER COMPANY.

H. E. PARSON, Supt., 457 Putnam Ave., Brooklyn, N. Y.

"Globe" Specials, Valves, Etc. "Glamorgan" Fire Hydrants

M. J. DRUMMOND & CO.

MANUFACTURERS OF

CAST IRON FLANGE GAS AND WATER PIPE

GENERAL SALES OFFICE, 192 BROADWAY, NEW YORK.

George Ormrod, Mangr. & Treas., Emaus, Pa.
John Donaldson, Prest., Betz Bldg., Phila., Pa.

EMAUS PIPE FOUNDRY.

DONALDSON IRON COMPANY. EMAUS, PA.

MANUFACTURERS OF

CAST IRON PIPE AND SPECIAL CASTINGS

FOR WATER AND GAS.

Also, FLANGE PIPE, LAMP POSTS, Etc.

We make the best and cheapest Trays in the market.

Church's Patent, Bolted or Riveted.

Write for Descriptive Pamphlet and prices before ordering elsewhere.

Purifier Trays

JOHN CABOT,

553-557 West 33d Street, New York City.

Bristol's Recording

PRESSURE GAUGE.

For continuous records of **Street Gas Pressure.** Simple in construction, accurate in operation and low in price.

Fully Guaranteed. Send for Circulars.

THE BRISTOL CO.,

Waterbury, Conn.

Silver Medal, Paris Exposition.

Practical Photometry,

By William Joseph Dibdin.

Price, $3.00.

A. M. CALLENDER & CO., 32 Pine St., N. Y. City.

(Copyrighted, 1894, by the AMERICAN METER CO.)

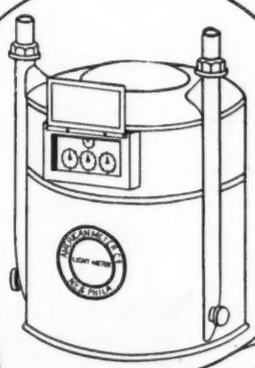
AMERICAN METER CO.

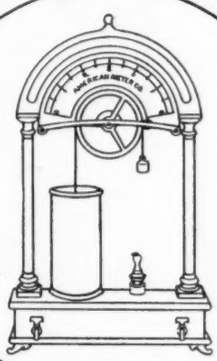
ESTABLISHED 1834. INCORPORATED 1863.

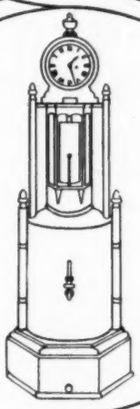
NEW YORK AND PHILADELPHIA,

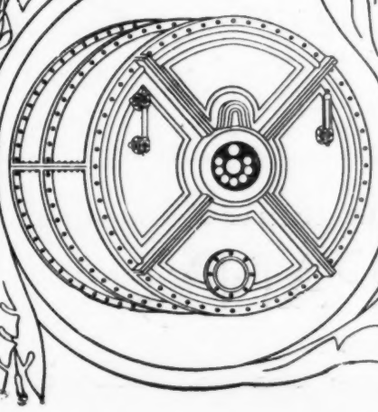
CHICAGO, ST. LOUIS,

SAN FRANCISCO.









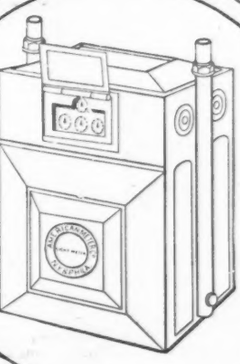
PUBLIC LIGHTING TABLE.

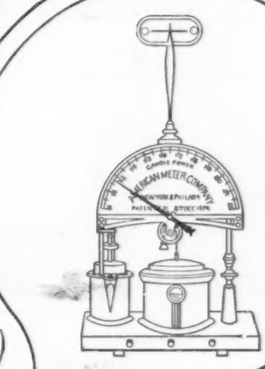
NOVEMBER, 1901.

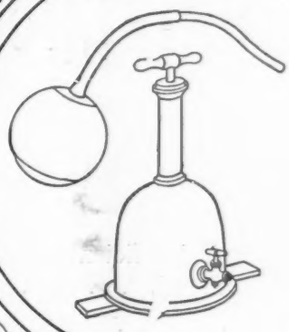
Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Extinguish	Table No. 2. New York City. All Night Lighting. Light.	Extinguish.
				P.M.	A.M.
Fri.	1	5.30 PM	11.00 PM	4.45	5.35
Sat.	2	5.30 LQ	12.00	4.45	5.35
Sun.	3	5.20	1.10 AM	4.45	5.35
Mon.	4	5.20	2.10	4.45	5.35
Tue.	5	5.20	3.10	4.40	5.45
Wed.	6	5.20	4.10	4.40	5.45
Thu.	7	5.20	5.40	4.40	5.45
Fri.	8	5.20	5.40	4.40	5.45
Sat.	9	5.20	5.40	4.40	5.45
Sun.	10	5.20 NM	5.40	4.40	5.45
Mon.	11	5.20	5.40	4.40	5.45
Tue.	12	5.20	5.40	4.30	6.00
Wed.	13	5.20	5.40	4.30	6.00
Thu.	14	5.20	5.40	4.30	6.00
Fri.	15	7.20	5.40	4.20	6.00
Sat.	16	8.20	5.40	4.30	6.00
Sun.	17	9.20	5.50	4.30	6.00
Mon.	18	10.20 FQ	5.50	4.30	6.00
Tue.	19	11.20	5.50	4.25	6.00
Wed.	20	12.30 AM	5.50	4.25	6.00
Thu.	21	1.40	5.50	4.25	6.00
Fri.	22	2.50	5.50	4.25	6.00
Sat.	23	4.00	5.50	4.25	6.00
Sun.	24	No L.	No L.	4.25	6.00
Mon.	25	No L. FM	No L.	4.25	6.00
Tue.	26	No L.	No L.	4.20	6.10
Wed.	27	5.10 PM	7.30 PM	4.20	6.10
Thu.	28	5.10	8.40	4.20	6.10
Fri.	29	5.10	9.50	4.20	6.10
Sat.	30	5.10	10.50	4.20	6.10

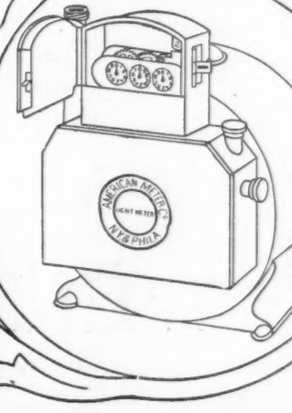
TOTAL HOURS LIGHTING DURING 1901.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	220.10	January	423.20
February	192.30	February	355.25
March	180.00	March	355.35
April	158.30	April	298.50
May	140.40	May	264.50
June	135.40	June	234.25
July	138.00	July	243.45
August	156.20	August	280.25
September	174.40	September	321.15
October	202.30	October	374.30
November	220.40	November	401.40
December	241.30	December	433.45
Total, yr.	2161.10	Total, yr.	3987.45





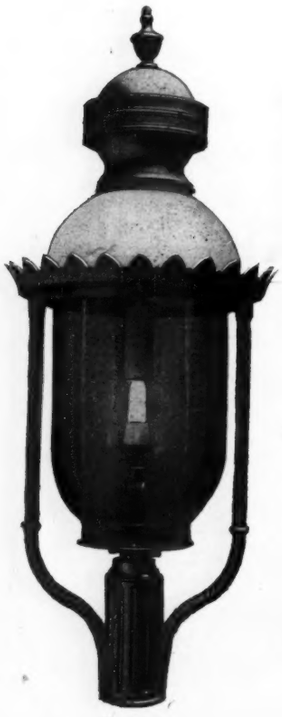




NEW YORK, 33 Nassau Street. PHILADELPHIA, Broad and Arch Streets. CHICAGO, Foot of Orleans Street. BOSTON, 624 Tremont Building.
CLEVELAND, 809 Cuyahoga Building. ST. LOUIS. 712 Roe Building. SAN FRANCISCO. 712 Polk Street.

WELSBACH STREET LIGHTING COMPANY

.... OF AMERICA ....



No. 36.

Controls and Operates the

Welsbach System of Street Lighting,

Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

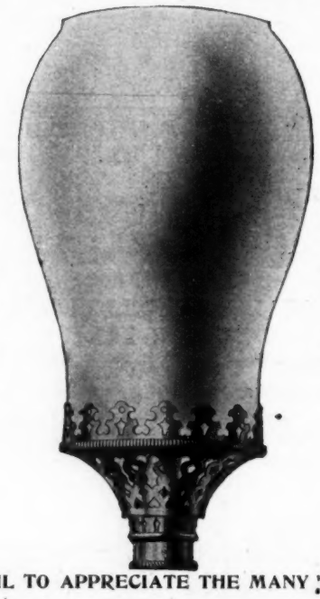
Correspondence Solicited from Gas Companies and Others Interested in Municipal and Outside Lighting.

No. 38.

UNIVERSAL WELSBACH BURNER.

The most practical, efficient and artistic burner yet produced. . . . . .

It contains an improved adjustable Bunsen so constructed as to permit of a wide range of variations in gas pressure without blackening the mantles and without an adjustable air shutter. . .



It can be used with all styles and sizes of glassware, either shades or globes. No further necessity to carry a stock of different burners for the many sizes and shapes of glassware.

GAS COMPANIES AND DEALERS CANNOT FAIL TO APPRECIATE THE MANY SALABLE FEATURES OF THIS NEW BURNER.

WELSBACH COMPANY,

GLOUCESTER, N. J. CHICAGO, ILLS.

Salesrooms in all the Leading Cities of the United States.

THE STANDARD DOUBLE SUPERHEATER

LOWE WATER GAS APPARATUS.

Under Contract, 1901:

Number of Sets to August 1, 1901, - - - - - - 27

Total Daily Capacity, - - - - 28,200,000 Cubic Feet.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

Established 1858. Incorporated 1890.
CHAS. E. GREGORY Prest. DAVID R. DALY V. Prest. & Treas.
H. D. ABERNETHY, Sec.

J. H. Gautier & Co.

Greene & Essex Streets,
Jersey City, N. J.

MANUFACTURERS OF

CLAY GAS RETORTS, FIRE CLAY TILES,
FIRE BRICK and FIRE CLAY SPECIALTIES.

Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

SOLE MANUFACTURERS OF THE

FLEMMING GENERATOR GAS FURNACE

A. H. GUTKES, President. E. L. RICE, Vice-President. H. A. PERKINS, Secretary.

Brooklyn Fire Brick Works,

MANUFACTURERS OF

CLAY RETORTS, FIRE BRICK,
Gas House and other Tile.

Office, 88 Van Dyke St., Brooklyn, N. Y.

Established 1854. Incorporated 1869.

LACLEDE
Fire Brick Manufg. Co.,

Manufacturers of { GAS RETORTS . .
FIRE BRICK . . .
RETORT SETTINGS

Water Gas Cupola Linings, Fire Clay, Etc.

Proprietors for the U. S., Coze System of Inclined Benches.

Estimates Furnished on Application for Most Successful Style of Construction.

Also for Free-Firing and Full and Half-Depth Regenerative Benches, for Burning either Coal or Coke in the Furnaces.

Office:
914, 915 & 916 Wainwright Building, St. Louis, Mo.

The Gas Engineer's Pocket-Book,

By HENRY O'CONNOR.

Comprising Tables, Notes and Memoranda relating to the Manufacture, Distribution and Use of Coal Gas, and the Construction of Gas Works.

PRICE, $3.50.

A. M. CALLENDER & CO., 32 Pine Street, New York City.

Adam Weber Sons,

Manhattan Fire Brick and Enameled Clay Retort Works.

Works, Weber, N. J.

Office, 633 East 15th St., New York.

Modern Recuperative Furnaces.

Standard Fire Brick and Gas Retorts.

ISAAC C. BAXTER, President.

Works,
LOCKPORT STATION, PA.

—ESTABLISHED 1864.—

JAMES GARDNER, JR., CO.,

PETER YOUNG, Sec'y and Treas.

Address all communications to
JAMES GARDNER, JR., CO., Box 277,
JOHNSTOWN, PA.

Successor to WILLIAM GARDNER & SON,

Fire Clay Goods for Gas Works.

HENRY MAURER & SON,

(ESTABLISHED 1856.)

EXCELSIOR FIRE BRICK & CLAY

RETORT WORKS

WORKS, Perth Amboy, N. J.
OFFICE, 418 to 422 East 23d St., N. Y.

Clay Gas Retorts,

BENCH SETTINGS,

Fire Brick, Tiles, Etc.

GEROULD'S IMPROVED RETORT CEMENT

A Cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick

Price List, f. o. b. Galesburg, Ills., or Buffalo, N. Y.

In Casks, 400 to 800 pounds, at 5 cents per pound.
In Kegs, 100 to 200 " " 6 " "
In Kegs less than 100 " " 7 " "

C. L. GEROULD, Galesburg, Ills.

For orders East of Buffalo, N. Y., or Pittsburg, Pa., freight will be paid to these points.

Parker-Russell Mining and Mfg. Co.,

CITY OFFICE,
417 Pine Street, St. Louis, Mo.

PROPRIETORS OF THE

OAKHILL GAS RETORT & FIRE BRICK W'KS

Our immense establishment is now employed almost entirely in the manufacture of

Materials for Gas Companies

We have studied and perfected three important points. Our retorts are made to stand changes of temperature, the strongest heats of the furnace, and the abrasion of feeding and emptying. We construct

Half and Full Depth Benches of Our Own Design,

Containing 6, 8 or 9 Retorts.

We have Greatly Improved our Recuperators. Coal or Coke can be used as Fuel in Furnaces.

THEO. J. SMITH, Prest. J. A. TAYLOR, Sec.
A. LAMBLA, Vice-Prest. and Supt.

BALTIMORE
RETORT & FIRE BRICK CO.

MANUFACTORY AT

LOCUST POINT, BALTIMORE, MD.

Clay Retorts, Blocks & Tiles

FIRE BRICK, FIRE CLAY,
AND FIRE CEMENT.

Our Improved Half and Full Depth Benches have been Adopted by Many Gas Companies.

WALDO BROS., 102 MILK ST., BOSTON, MASS.

Sole Agents for New England States.

JOHN DELL,
General Manager.

MISSOURI FIRE BRICK CO.,

ESTABLISHED 1882.

MANUFACTURERS OF

Gas Retorts, Bench Settings, Fire Brick, Cupola Linings, Etc.

We are prepared to furnish and erect COMPLETE, Half and Full Depth Benches of 6's, 8's, 9's, with Regenerative Furnaces, Constructed to Burn either Coal or Coke. Also Plain Benches.

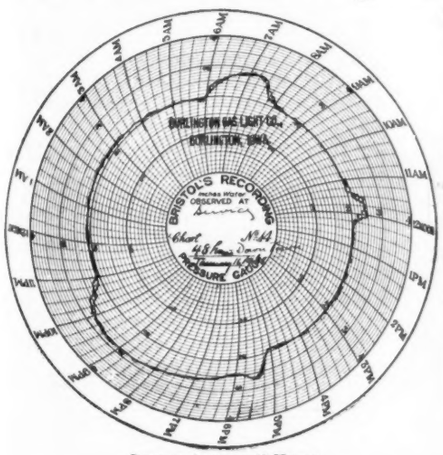
CORRESPONDENCE IS RESPECTFULLY SOLICITED.

{ CITY OFFICE: 411 Olive St., Continental Bank, } ST. LOUIS, MO.

A GAS GOVERNOR,

Particularly a CONNELLY Gas Governor,

Is as essential to the operation of a gas works as the Governor of any of our great States is necessary to the successful working of one of these political bodies.



DOUBLE RECORD 48 HOURS.

BURLINGTON GAS LIGHT CO., 215 Jefferson Street,
Burlington, Iowa, April 8, 1901.

MR. S. F. HAYWARD, Mgr. Connelly Iron Sponge and Governor Co., New York:

Dear Sir: You are at liberty to keep the pressure sheets sent you recently. If my testimony would have any weight with your prospective customer, you might tell him that all that is necessary to make a CONNELLY Governor just as automatic as the charts we send you indicate, 24 hours in the day and 365 days in the year, is to spend about a half hour's time each YEAR cleaning it. Yours truly, E. D. CLARY, Supt.

Mr. Clary is only one of scores of gas managers who find Connelly Governors absolutely indispensable. We are in business to give you all the information you can wish about Governors.

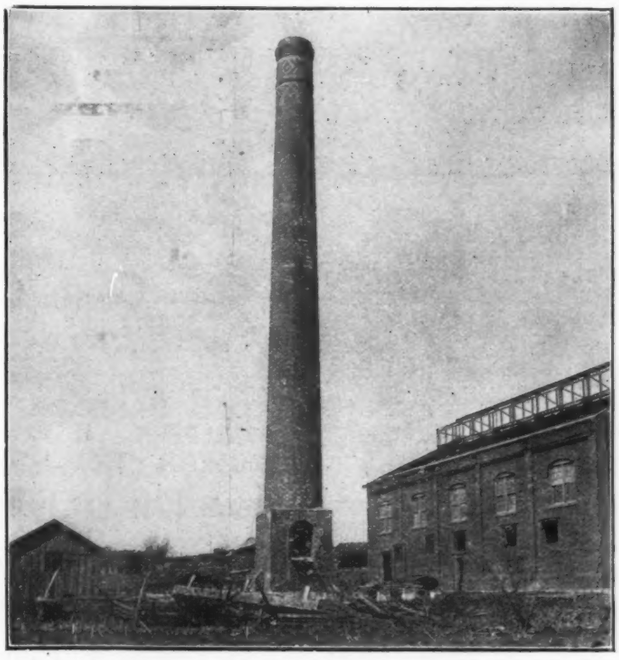
Connelly Iron Sponge and Governor Co.,

395 BROADWAY, NEW YORK.

ADAM WEBER SONS,

Manhattan Fire Brick & Enameled Clay Retort Works,

Designers and Builders of Chimneys of Perforated Radial Bricks.



Chimney of perforated radial bricks, designed and built by ADAM WEBER SONS for the Nazareth Cement Company, at Nazareth, Pa.

A. M. Young, President, New England Engineering Co., New York, March 30th, 1901.

Adam Weber Sons, 633 E. 15th St., N. Y. City—Gentlemen: It is a pleasure for us to state that the chimney built for us by you, at the works of the Nazareth Cement Co., at Nazareth, Pa., is an exceptionally fine one. We are certainly pleased with the workmanship on the same, and feel that there is no finer chimney anywhere if construction is considered. Yours very truly,

H. P. HAMPSON,
General Manager New England Engineering Company, at Nazareth, Pa.

Main Office and Depot, No. 633 East 15th St., New York City. Works at WEBER, on Raritan River, Middlesex County, N. J.

The Gas Engineer's Laboratory Handbook,

By JOHN HORNBY, F.I.C.

Price, $2.50.

A. M. CALLENDER & CO., 32 Pine St., N. Y. City.

Practical Hints on the Construction and Working of Regenerator Furnaces,

By MAURICE GRAHAM, Assoc M. Inst. C.E.

Price, $1.25. For Sale by

A. M. CALLENDER & CO., No. 32 Pine Street, New York City.

JAMES D. PERKINS, President. F. SEAVERNS, Treasurer.

THE PERKINS COMPANY,

228 and 229 Produce Exchange, New York City.

TIDEWATER SALES AGENTS FOR THE FOLLOWING:

Ocean Mine Youghiogheny Gas Coal,
Old Kentucky Shale and O. K. Boghead.

SHIPMENTS FROM NEW YORK, PHILADELPHIA, BALTIMORE AND NORFOLK.

BERWIND-WHITE COAL MINING COMPANY'S

Ocean Westmoreland Gas Coal.

Offices:
Washington Building, New York.
Betz Building, Philadelphia.

STRICTLY High Grade. . . . .
Carefully prepared.
For Gas Making or
Heavy Steaming.

GAS TAPPING MACHINES

—FOR—

Drilling and Tapping Pipe under Pressure

WITHOUT ANY ESCAPE OF GAS.

They are Strong and Compact.

Size of Combination Drills and Taps ¾ to 4-Inch.

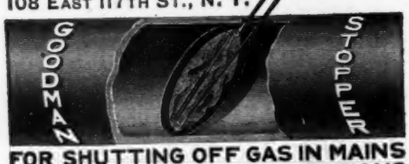
Machines Sent to any Gas Company for Thirty Days' Trial.

Send for Circulars.

Geo. Light,
DAYTON, O.

SAFETY GAS MAIN STOPPER CO.

108 EAST 117TH ST., N. Y.



FOR SHUTTING OFF GAS IN MAINS TEMPORARILY DURING ALTERATIONS AND REPAIRS

SEND FOR CATALOGUE.

Jeffrey Elevating Machinery

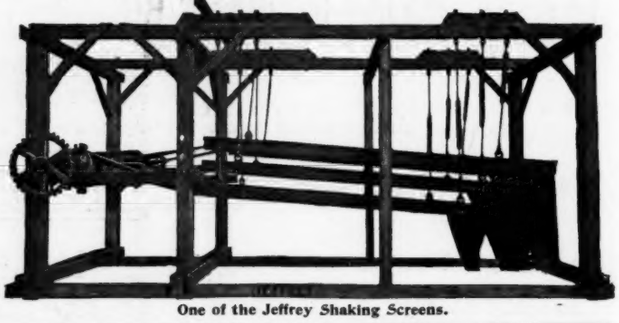
FOR HANDLING

COAL, COKE, ETC.

DESIGNED TO SUIT THE CONDITIONS.

COAL CRUSHERS.
COAL HANDLING MACHINERY.
SCREENS.
POWER TRANSMISSION MACHINERY.

Address THE JEFFREY MFG. COMPANY,
COLUMBUS, OHIO, U. S. A.



One of the Jeffrey Shaking Screens.

THE CHEMISTRY OF ILLUMINATING GAS,

By NORTON H. HUMPHRYS. Price, $2.40.

Orders may be sent to

A. M. CALLENDER & CO., 32 Pine St., N. Y.

KELLER ADJUSTABLE COKE CRUSHER.

Strong, Simple, Durable. Will Crush any Size Desired.

C. M. KELLER,
Sec. & Supt. Gas Lt. & Coke Co.,
Columbus, Ind.
Correspondence Solicited.

Do You Wish to Know

what size of pipe to use to convey any quantity of gas, any distance, with any loss of pressure and any initial or final pressure? Then use

Cox's Gas Flow Computer,

as it gives this information accurately at sight, without mental effort. No calculations needed. Saves time, money and mistakes.

Price, 6.5 x 8 inches, in cloth case, $2.50. For sale by

A. M. Callender & Co., 32 Pine St., N. Y.

POOLE ON FUELS.

THE CALORIFIC POWER OF FUELS.

By HERMAN POOLE, F.C.S.

Second Edition. Price, $3. For Sale by

A. M. CALLENDER & CO., 32 Pine St., N.Y. City.

Edmund H. McCullough, President. Chas. F. Godshall, Treasurer. H. C. Adams, Secretary. Henry Wharton, Assistant Secretary.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Pa.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J.,
WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa.

THE SUN OIL CO.

Crude Oil, Gas Naphtha,
Refined Petroleum, Gas Oil.

Toledo, O., and Pittsburgh, Pa.

Standard Oil Company,

GAS NAPTHA DEPARTMENT.

GAS NAPTHA.

GAS OIL.

Correspondence Solicited.

26 Broadway, New York City.

Hughes' "GAS WORKS,"

Their Construction and Arrangement,

And the Manufacture and Distribution of Coal Gas.

Originally written by SAM'L HUGHES, C.E.
Rewritten and Much Enlarged by

WM. RICHARDS, C.E.

Eighth Edition, Revised, with Notices of Recent Improvements.

Price, $1.65.

A. M. CALLENDER & CO.,
32 Pine St., N. Y. City.

BINDER for the JOURNAL.

Price, $1.00.

A. M. CALLENDER & CO., 32 Pine Street, N.Y.

—THE—

Valuation of Gas, Electricity and Water Works

FOR ASSESSMENT PURPOSES.

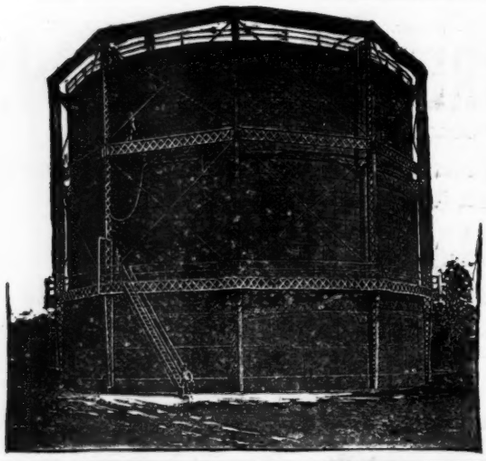
SECOND EDITION.

THOS. NEWBIGGING, M.Inst.C.E., and WM. NEWBIGGING, Assoc.M.Inst.C.E.

With an Appendix of Decided Cases.

Price $2. For Sale by

A. M. CALLENDER & CO.,
32 Pine Street, N. Y. City.



DAVIS & FARNUM MFG. CO.,
WALTHAM, MASS.

Principal Office & Works, Waltham, Mass. Boston Office, R'm 18, Vulcan Bldg., 8 Oliver St.

Single, Double and Triple-Lift Gasholders of any Capacity. Tubular, Pipe and Sinuous Friction Condensers of all Sizes.

Steel Tanks for Gasholders, Iron Roof Frames and Floors, Purifying Boxes, Center Seal or Valve Connections, Bench Work, Reversible Lime Trays.

Self-Sealing and Pressed Steel Mouthpiece Lids.

Coke Borrows, Coal Wagons, and all Apparatus Requisite for a Complete Gas Works.

Also, Gas and Water Pipe, Flanged Pipe, Sugar House Work, and Special Castings of all Descriptions.

BAXTER & YOUNG,
CONTRACTING AND CONSULTING GAS ENGINEERS.

Examination and Values Ascertained of Artificial and Natural Gas Properties.

COMPLETE GAS WORKS ERECTED.

Artificial and Natural Gas Mains Furnished and Laid.

GAS PROPERTIES PURCHASED.

OFFICE: WAYNE COUNTY BANK BUILDING,
Rooms 201 & 202. DETROIT, MICH.

A. E. BOARDMAN, C. E.,
Consulting and Contracting Engineer.

Particular attention given to Gas, Water and Electric Plants. Long and successful experience with the problem and practice of

Filtration for Public Water Supply.

BREVARD, N. C.

JAMES T. LYNN,
GAS ENGINEER AND CONTRACTOR,

Wayne Bank Building, - DETROIT.

GAS PROPERTIES PURCHASED.

Geo. Shepard Page's Sons.
GAS MACHINERY.

Correspondence Solicited.

180 Fulton Street, New York City.

DAVID LEAVITT HOUGH,
Consulting Engineer AND **CONTRACTOR,**

374 FIFTH AVE., N. Y.

KERR MURRAY MANUFACTURING CO.

Latest Design Rotary Exhauster, With Automatic Governor,

Single or Double-Lift Gasholders,

WITH OR WITHOUT STEEL TANKS.

Storage Oil Tanks, Condensers and Scrubbers.

Purifying Boxes, with Cover-Lifting Apparatus, Center Seal or Valve System Connections and Oxide Elevator.

REVERSIBLE WOOD PURIFYING AND SCRUBBING TRAYS.

Mouthpieces, Standpipes, Etc.; in Fact, All Classes of Ironwork for Benches.

DOUBLE GATE ALL IRON GAS VALVES, 3 TO 36 INCHES DIAMETER.

ALL SIZES OF STREET SPECIAL CASTINGS.

FORT WAYNE, IND.

BARTLETT, HAYWARD & CO.

BALTIMORE, MD.

Triple, Double and Single-Lift Gasholders.

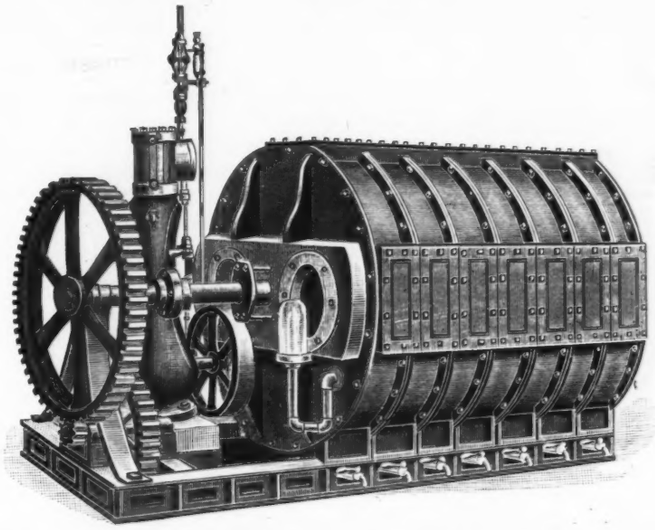
Iron Holder Tanks.

ROOF FRAMES.

Girders.

BEAMS

PURIFIERS.



CONDENSERS.

Scrubbers.

Bench Castings.

OIL STORAGE TANKS.

Boilers.

PATENT STANDARD WASHER-SCRUBBER.

The best apparatus for the extraction of all Ammonia and a large proportion of Carbonic Acid and Sulphureted Hydrogen. The Scrubber has been materially improved and is provided with patented Wooden Segmental Grids, instead of Metallic Discs, thus reducing the weight on shaft and power for operating same.

The Wilkinson Water Gas Process.

THIRTY-CANDLE, NON-CONDENSABLE, FIXED GAS. THE MOST SUCCESSFUL GAS PROCESS IN OPERATION.

MILL'S REVERSIBLE LIME TRAYS.

Gas Works Designed and Constructed.

ALEX. C. HUMPHREYS, M. E., M. Inst. C. E. ARTHUR G. GLASGOW, M. E., M. Inst. C. E.

HUMPHREYS & GLASGOW,

BANK OF COMMERCE BLDG.,
31 Nassau Street,
New York.

38 VICTORIA STREET,
London S. W.,
England.

CONSULTING GAS AND ELECTRIC LIGHT ENGINEERS.

PROPERTIES PURCHASED AND EXAMINED.

GASHOLDER TANKS AND
GAS WORKS MASONRY COMPLETE

Plans prepared and Estimates furnished at short notice.

J. P. WHITTIER,

238 Java Street, Brooklyn, N. Y.

GEORGE R. ROWLAND.

Formerly with the Continental Iron Works.

Draughtsman and Constructing Engineer.

Drawings, Specifications and Estimates furnished for the construction of new works or alteration of old works. Special attention given to Patent Office drawings.

Office, No. 245 Broadway, N. Y. City.

Foundries and Works: { Millville, N. J. / Florence, " / Camden, "

R. D. WOOD & CO.

ENGINEERS, IRON FOUNDERS, MACHINISTS

400 Chestnut Street, PHILADELPHIA, PA.

MANUFACTURERS OF

Cast Iron Pipe.

SOLE MAKERS OF

THE MITCHELL SCRUBBER

(PATENTED.)

PURIFIERS, CONDENSERS, SCRUBBERS, BENCH WORK.

BUILDERS OF

Gas Holders.

Single, Double and Triple Lifts, with or without Wrought Iron or Steel Tanks.

CUTLER'S PATENT FREEZING PREVENTER
For Gas Holder Cups.

THE TAYLOR
REVOLVING BOTTOM GAS PRODUCER.

HEAVY LOAM CASTINGS, DUNHAM SPECIALS, HYDRAULIC WORK, LAMP POSTS, VALVES, Etc.

ISBELL-PORTER CO.,

ENGINEERS AND CONTRACTORS FOR THE

Construction and Extension of Gas Works.

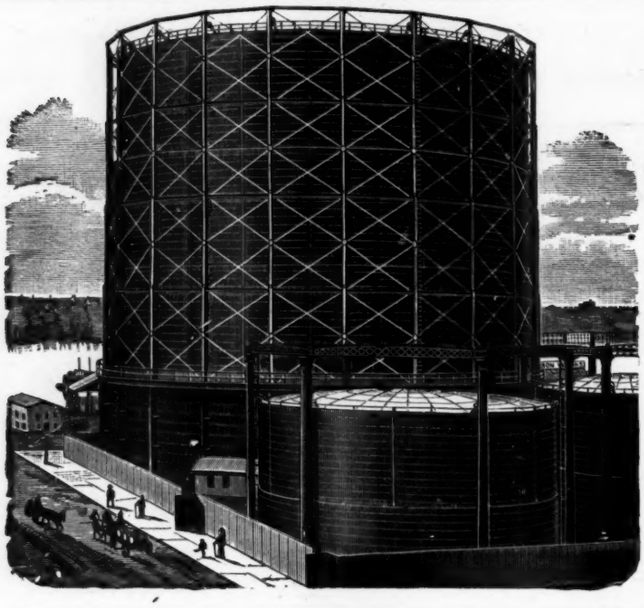
FOUNDERS AND MACHINISTS.

MANUFACTURERS OF

All Ironwork and Machinery Required in a Gas Plant.

Estimates, Drawings and Specifications furnished for the Alteration, Improvement, or Extension of Existing Works or the Construction of New Works.

245 Broadway, New York City. —OFFICES— Bridge & Ogden Sts., Newark, N. J.



The Continental Iron Works,

THOMAS F. ROWLAND, President.
WARREN E. HILL and CHAS. H. CORBETT, Vice-Presidents.
THOMAS F. ROWLAND, Jr., Secretary & Treasurer.

West and Calyer Sts. (Near 10th & 23d St. Ferries)
NEW YORK, Borough of Brooklyn.

BUILDERS OF

Gas Holders.

Single and Multiple Section Gas Holders a Specialty.

STEEL GAS HOLDER TANKS.

BENCH CASTINGS, RETORT LIDS.

Hydraulic Mains, Condensers, Scrubbers, Purifiers, Valves, Etc.

Self-Sealing Retort Mouthpieces & Lids

For Round, Oval, or "D" Retorts.

ILLUMINATING GAS! FUEL GAS!

THE LOOMIS PROCESS.

Now in successful operation at Works of John Russell Cuttlery Co., Turner's Falls, Mass., and Henry Disston's Son's Saw Works, Tacony, Pa.

The Cheapest Gas Generating System in the World.

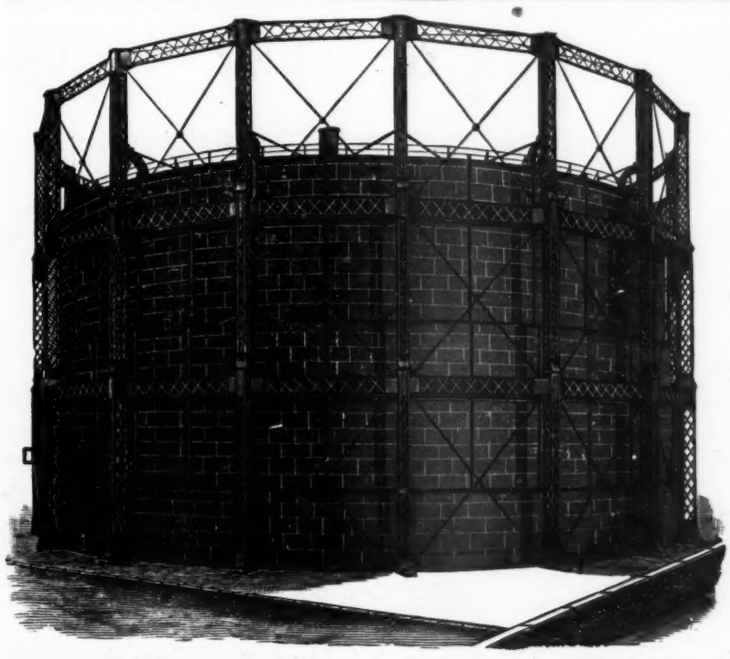
Plans and Estimates Furnished.

BURDETT LOOMIS, - - Hartford, Conn.

The Chemistry of Illuminating Gas,

By NORTON H. HUMPHRYS. Price, $2.40.

A. M. CALLENDER & CO., 32 PINE ST., N. Y. CITY



WILLIAM STACEY, Prest. T. H. BIRCH, Asst. Mangr.
J. E. STACEY, Vice-Prest. & Gen. Mangr. R. J. TARVIN, Sec. & Treas.

THE STACEY MANUFACTURING CO.

Established 1851.

Single, Double and Triple-Lift

GASHOLDERS,

Of any Capacity, with or without Wrought Iron or Steel Tanks.

Hydraulic Mains, Condensers, Scrubbers, Purifiers, Valves, etc.

Coal Gas Benches, Roof Frames,

OIL STORAGE TANKS.

Pressed Steel Mouthpiece Lids, Self-Sealing Mouthpiece Lids.

General Office: Cincinnati, O.
Eastern Office: 911 Drexel Building, Philadelphia, Pa.

RITER-CONLEY MFG. CO.,

GASHOLDERS, with or without Steel Tanks.

Purifiers, Condensers, Scrubbers, Oil Tanks, Smoke Stacks.

STEEL ROOFS and BUILDINGS.

PLATE AND STRUCTURAL WORK OF EVERY DESCRIPTION.

GENERAL OFFICE: Pittsburg, Pa. EASTERN OFFICE: 39-41 Cortlandt St., New York City.

WM. HENRY WHITE,

No. 32 Pine Street, - - - New York City.

ENGINEER AND CONTRACTOR FOR THE

ERECTION AND EXTENSION OF

GAS, WATER, AND ELECTRIC LIGHT WORKS.

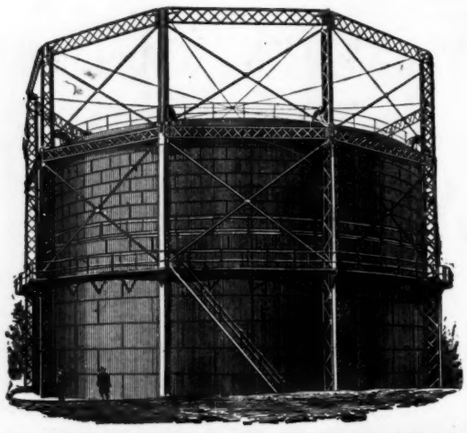
Correspondence with Gas Companies contemplating extending or improving their Plants respectfully invited.
Plans and Estimates Furnished.

1901 DIRECTORY 1901

OF AMERICAN GAS COMPANIES.

Price, - - - - - - - - - $5.00.

A. M. CALLENDER & CO., - - No. 32 Pine Street, New York.



1842 ✻ Deily & Fowler, ✻ 1901

LAUREL IRON WORKS.

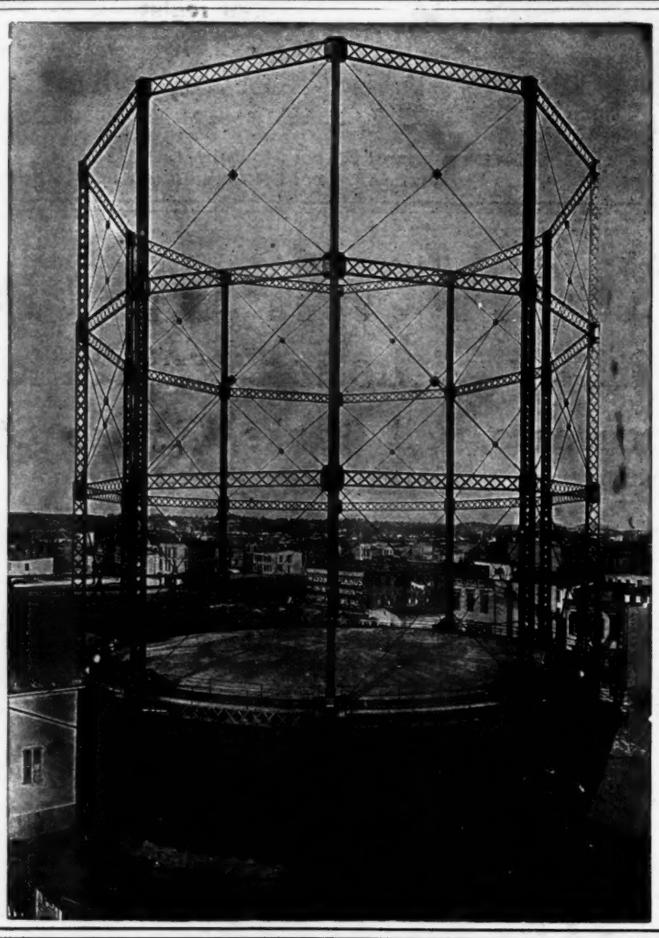
Office, No. 39 Laurel Street, Philadelphia, Pa.

BUILDERS OF

Gasholders

Single or Telescopic. With or Without Iron or Steel Tanks.

OIL TANKS, WATER TANKS, AND GENERAL WROUGHT IRON WORK.



The order for this Triple-Lift Holder and Steel Tank was received by the Logan Iron Works from the Union Gas Light Company, of East New York. The contract was completed and the Holder was in actual use in 90 days from receipt of order. Capacity of Holder, 500,000 Cu. Ft.

LOGAN IRON WORKS,

Brooklyn, N. Y.

MANUFACTURERS OF

Single or Multiple-Lift

GASHOLDERS,

Complete with Steel Tanks.

BENCHES, SCRUBBERS,
CONDENSERS,
PURIFIERS, IRON ROOFS,
Self-Sealing Retort Lids,
AND ALL PARTS OF
GAS WORKS APPARATUS.

Contractors for
Complete Works.

ALSO, SOLE MANUFACTURERS OF

C. W. BLODGET'S
HOT GAS SCRUBBER.

FIELD'S ANALYSIS

For the Year 1900.

An Analysis of the Principal Gas Undertakings in England, Scotland and Ireland. Being the Thirtieth Year of Publication.

Compiled and Arranged by

JOHN W. FIELD,

Secretary and General Manager of The Gas Light and Coke Company, London.

Price $5. For Sale by

A. M. CALLENDER & CO., - No. 32 Pine Street, N. Y. City.

Established 1854.

D. McDONALD & CO.,

MANUFACTURERS OF

WET AND DRY METERS, STATION METERS AND METER PROVERS.

ALSO MAKERS OF

THE GLOVER PREPAYMENT METER.

The amount of gas delivered for the coin can be instantly and positively changed without removing the meter or replacing any parts.

The gas registered agrees absolutely with the amount purchased by the coin.

WE HAVE MADE AND SOLD IN THE UNITED STATES

OVER 70,000 OF THESE METERS,

ALL OF WHICH ARE GIVING PERFECT SATISFACTION.

Correspondence Solicited.

561 West Forty-seventh Street, NEW YORK. | 51, 53 & 55 Lancaster Street, ALBANY, N. Y. | 34 & 36 West Monroe Street, CHICAGO.

POOLE ON FUELS.

THE CALORIFIC POWER OF FUELS.

WITH A VERY FULL COLLECTION OF TABLES OF HEATS OF COMBUSTION OF FUELS, SOLID, LIQUID AND GASEOUS.

TO WHICH IS ALSO APPENDED

THE REPORT OF THE COMMITTEE ON BOILER TESTS OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS, DECEMBER (1897); TABLES OF CONSTANTS USED.

By HERMAN POOLE, F.C.S.

Second Edition. Price $8. For Sale by

A. M. CALLENDER & CO. - - No. 32 Pine Street, New York City.

PRACTICAL HANDBOOK ON

GAS ENGINES,

With Instructions for Care and Working of the Same.

By G. LIECKFELD, C.E.

Translated with Permission of the Author, by GEO. M. RICHMOND, M.E.

PRICE, $1.00

A. M. CALLENDER & CO., 32 Pine Street, New York City.

NATHANIEL TUFTS METER CO.,

8 Medford Street, Boston, Mass.

MANUFACTURERS OF

DRY GAS METERS.

Station Meters of any Capacity.

Test and Experimental Meters, Pressure Registers, Pressure Gauges.

METER PROVERS, PHOTOMETERS, STREET LANTERNS, ETC., ETC.

Prepayment Gas Meters.

Established 1849. With the best facilities for manufacturing, is enabled to furnish reliable work and answer orders promptly.

CHARLES E. DICKEY. JAMES B. SMALLWOOD. CHARLES H. DICKEY.

THE MARYLAND METER AND MANUFACTURING CO.

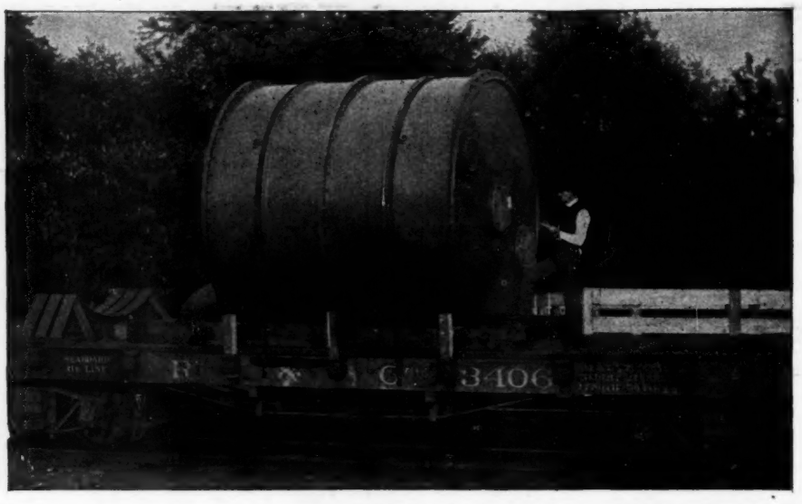
Established 1866.

BALTIMORE, North & Saratoga Sts. **CHICAGO, 88 to 92 West, Jackson Boulevard.**

SAN FRANCISCO, 221 Front St.

CONSUMERS' & STATION METERS, PRESSURE GAUGES, Etc., Etc.

"Perfect" Gas Stoves.



Do You Want One of these this year?

We have built station meters in all sizes—from 4-foot to 14-foot—satisfactorily. We can build yours. . . . . .

THE

Keystone Meter Co.,

ROYERSFORD, PA.

PACIFIC AGENTS:

WIESTER & CO., 22 Second Street, San Francisco, Cal.

NOW READY.

THE SIXTH (AND CENTENARY) EDITION

— OF THE —

Handbook for Gas Engineers and Managers.

By THOMAS NEWBIGGING, M. Inst. C.E.

This Edition of the "Handbook for Gas Engineers and Managers" is a great improvement on all previous editions. Much of the text has been re-written, in order to keep the work abreast of the constant advances that are being made in the Gas Industry.

PRICE, - - $6.00.

A. M. CALLENDER & CO., - - No. 32 Pine Street, N. Y. City.

AMERICAN METER COMPANY,

NEW YORK, PHILADELPHIA, SAN FRANCISCO.

PREPAYMENT METERS.

THEIR CONSTRUCTION IS SUCH THAT THEY MAY BE READILY READJUSTED WHEN THE SCALE OF GAS RATES IS CHANGED.

HELME & McILHENNY,

Established 1848. 1339 to 1349 Cherry Street, Philadelphia, Pa.

MANUFACTURERS OF

Wet and Dry Gas Meters, Station Meters, Provers, Gauges, Etc.

METERS REPAIRED

PREPAYMENT GAS METERS.

Our Own Patents. Strong. Simple. PROMPT ATTENTION. CORRESPONDENCE SOLICITED.

METRIC METAL COMPANY,

MAKERS OF

GAS METERS for NATURAL and ARTIFICIAL GAS.

Special Attention given to Repairing METERS of all Makes.

FACTORY AT ERIE, PA.

EXCERPTS FROM DECISIONS

—OF THE—

BOARD OF GAS COMMISSIONERS of the COMMONWEALTH OF MASSACHUSETTS.

MR. E. H. YORKE, NEW HAVEN, CONN., Dec. 1, 1898.

Dear Sir:—I am in receipt of a copy of "Excerpts from the Decisions of the Board of Gas Commissioners," which is a handy compilation in book form of extracts from the most recent decisions of the Gas Commission of Massachusetts.

I note that most of these extracts are broad and safe-guiding precepts, which apply with equal force to one Company as to another. The 13 years' existence of the Board of Gas Commissioners with its unusual opportunities for acquiring information, have justly made it a high and safe authority in all matters pertaining to the management, obligations, and rights of Gas Companies. Your little book will serve as a valuable reference library in settling legal complications which often arise between a Gas Company and its customers.

Yours truly, (Signed) F. C. SHERMAN, Superintendent.

A 28-page Pamphlet containing the cream of this Board's decisions as to the proper management of Gas Companies.

Compiled by E. H. YORKE. Price $1.00. Address

A. M. CALLENDER & CO., - No. 32 Pine Street, New York.

The Advertisement of

THE WESTERN GAS CONSTRUCTION COMPANY, Engineers and Builders,

Improved Double Superheater Lowe Water Gas Apparatus—Manufacturers of General Gas Works Machinery—Builders of Gas Works,

FORT WAYNE, IND.,

Occupies this Space Every Alternate Week.

JOHN J. GRIFFIN & CO.,

1513-1515-1517-1519-1521 Race Street, Philadelphia,

559 West 47th Street, New York.
WM. S. GRIBBEL, Manager.
TELEPHONE, 25-83.

34 West Monroe Street, Chicago.

MANUFACTURERS OF

Prepayment Meters, Consumers' Meters, Station Meters,

Provers, Registers, Gauges, Experimental Apparatus, Etc.

Prompt Attention Given to All Repairing.

OUR SPECIAL NATURAL GAS METER

Is the Best ever offered. Over 30,000 now in use.

The Positive Prepayment Meter.

. . SIMPLE . .

. DURABLE .

. ACCURATE .

. RELIABLE .

All Parts Interchangeable

This Meter is an unqualified success. Its simplicity of construction, and the positive character of the service performed by it, have given it pre-eminence.

WE HAVE MADE AND SOLD OVER 50,000 OF THESE PREPAYMENT METERS.

Needs only the Care Given an Ordinary Meter.
Saves MONEY, TIME and CONSUMERS.
Dispenses with "DEPOSITS" and Increases OUTPUT.